"THE ENGINEER," OCTOBER 26, 1928.

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With METALLURGICAL SUPPLEMENT.

The Engineer.

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VOL. CXLVI.—No. 3798] LONDON: FRIDAY EVENING, OCTOBER 26, 1928 [PRICE { WITH SUPPLEMENT } ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The Director-General, India Store Department, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for—

SCHEDULE 1.—EIGHT BOILERS (VERTICAL), 8ft. 6in. diam., Multi-tubular, for well drilling.

SCHEDULE 2.—MATERIALS for FOURTEEN COMPLETE BOGIES for Rolling Stock.

Tenders due on the 13th November, 1928, for No. 1, and on the 16th November, 1928, for No. 2.

Forms of Tender obtainable from the above at a fee (which will not be returned) of 5s. for each schedule. 9937

Assistant Engineers Required by the PUBLIC WORKS DEPARTMENT of the GOVERNMENT of UGANDA, for a tour of 20 to 30 months' service, with possible extension. Salary, £480, rising to £720 a year by annual increments. Outfit allowance of £30 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, 22 to 28 years of age, must have passed the Examination to qualify for Associate Membership of the Institution of Civil Engineers or hold professional qualifications recognised by the Institution as exempting from parts "A" and "B" of that examination. Preference will be given to candidates who have had some practical experience of Civil Engineering Work.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/1034. 9938

Assistant Waterworks Engineers (2) required by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT for two tours of not less than 12 nor more than 18 months' service and possible extension. Salary £480 for the first three years, then £510, rising by annual increments to £920 a year. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates must have attained the age of 24 and must not be more than 35. They must have obtained an Engineering Degree at a recognised University or have passed Sections "A" and "B" of the A.M.I.C.E. examination or the Associateship in Civil Engineering of the City and Guilds Institute, or possess such other Degree, Diploma or Distinction in Engineering as may be considered satisfactory. They must have had experience under a qualified civil engineer on the design of waterworks schemes, and preference will be given to those who have also had practical experience on the construction of such works with engineers or contractors.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/950. 9900

The Government of INDIA REQUIRE a FOREMAN for an ORDNANCE FACTORY in INDIA (Appointment 109). Qualifications: (1) Should have served a full apprenticeship with a mechanical engineering firm of good standing; (2) have had subsequent experience in control, in an engineering workshop on repetition work, including office routine. Knowledge of electrical engineering would be an advantage; (3) age 35-45 years. Terms: salary Rs. 575-20-655 per mensem with prospects of further increases; Provident Fund. Agreement for five years in first instance. Free second-class passage to India and return passage on satisfactory termination of services; free quarters; medical examination.—Further particulars and forms of application may be obtained on request by postcard (quoting Appointment 109) from the SECRETARY TO THE HIGH COMMISSIONER FOR INDIA, General Department, 42, Grosvenor-gardens, London, S.W. 1. Last date for receipt of applications 10th November, 1928. 9889

Waterworks Engineers (2) REQUIRED by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT for two tours of 12 to 18 months' service, with possible extension. Salary £800, rising by annual increments of £40 to £920 a year; seniority allowance of £72 a year whilst on duty in the Colony. Free quarters, passages and liberal leave with full salary. Candidates, between 30 and 40 years of age, must possess a thorough knowledge of and experience in design and construction of waterworks and in the investigation of water supplies in the Tropics and elsewhere. Must be Corporate Members of the Institution of Civil Engineers.—Apply at once by letter, stating age, qualifications and particulars of experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/906 9901

University of the Witwatersrand, JOHANNESBURG, SOUTH AFRICA.

JUNIOR LECTURER IN ELECTRICAL ENGINEERING.

APPLICATIONS are INVITED for the above POST.

The salary offered is at the rate of £354 per annum, rising by two annual increments of £27 10s. to a maximum of £409 per annum, of which £300-25-£350 is pensionable. Participation in the Pension Scheme at the rate of 6 per cent. per annum is compulsory, the Government providing the same amount.

A sum of £60 will be allowed towards passage expenses to South Africa, subject to a proportionate refund in the event of resignation from appointment within two years of assumption of duty; half salary paid from the date of embarkation.

The following qualifications are of first importance in connection with the appointment:—

(a) Drawing-office experience in a manufacturing organisation;

(b) Technical training in a University or equivalent training in a Technical Institution.

Applicants are requested to give full particulars of their career, educational and professional, and to supply copies of testimonials and references as to character.

Duty should be assumed on 1st February, 1929, or as soon as possible thereafter.

Applications, in triplicate, must reach the SECRETARY TO THE HIGH COMMISSIONER FOR SOUTH AFRICA, Trafalgar-square, London, W.C. 2 (from whom forms of application and further particulars may be obtained), not later than the 1st November, 1928. 9746

The Engineer

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The Institution of Structural ENGINEERS.
MODIFIED EXAMINATION FOR ASSOCIATE-MEMBERSHIP.

This Examination was instituted two years ago for the purpose of examining candidates who for reasons of age, &c., are unable to take the full examination. It consists of a test in Practical Design and Calculations worked under certain conditions at the candidate's own office or home, and is intended to test him in the same way as would work for a client.

The LAST of these examinations will be held on 17th November, and applications must be received on or before Monday, 12th November.

Candidates, who must be structural engineers at least 30 years of age, with at least 10 years' approved practical experience, may obtain particulars and entry form from the undersigned.

When this Examination has been completed, admission will subsequently be through the channels of the ordinary Examinations only.

By Order of the Council,
MAURICE G. KIDDY,
Secretary.

10, Upper Belgrave-street, London, S.W. 1.
23rd October, 1928. 9919

South Indian Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of—
PRESSED STEEL SLEEPERS.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tenders for Pressed Steel Sleepers," with the name of the firm tendering, must be left with the undersigned not later than Twelve Noon on Friday, the 9th November, 1928.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of the specification.

Copies of the drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France, 24th October, 1928. 9940

PUBLIC NOTICES

Congleton Corporation Water-Works.
INTENDED ADDITIONAL WORKS.
CONTRACT NO. 2.
TO REINFORCED CONCRETE CONTRACTORS.

The above Corporation are prepared to receive TENDERS from contractors experienced in the construction of Reinforced Concrete Elevated Reservoirs for the undermentioned WORKS, to be carried out within the Borough of Congleton, Cheshire:—

(1) Moss Farm Elevated Reservoir, containing 150,000 gallons.
(2) Forge Underground Storage Reservoir, containing 150,000 gallons.
(3) The Tower Elevated Reservoir, containing 250,000 gallons.

Together with

The whole of the necessary Cast Iron Inlet and Outlet Piping; Laying about 1700 Yards of 7in. Cast Iron Pumping Main; Alterations to the existing Forge Pumping Station and other Works in connection therewith.

Conditions of contract, specification, forms of Tender and all other information can be obtained from, and plans inspected at the office of the Borough Engineer, Mr. W. H. Duncan Arthur, M. Inst. Water Engineers, Town Hall, Congleton; or from Mr. Edw. Wilson Dixon, M. Inst. C.E., 3, East Parade, Leeds, on payment of Five Pounds (cheque), returnable on receipt of a bona fide Tender and the return of all documents supplied.

The Corporation do not bind themselves to accept the lowest or any Tender.

Sealed Tenders to be sent in to the undersigned not later than 10 a.m., November 19th, 1928, endorsed "Waterworks Contract, No. 2."

EDWARD A. PLANT,
Town Clerk.
9922 Congleton.

The Madras and Southern MAHRATTA RAILWAY COMPANY, Ltd., invite TENDERS for—
2390 cwt. SPRING STEEL.

Tenders are due in on Tuesday, 13th November, 1928, by 2.00 p.m.

Tender form obtainable at address below, fee ONE GUINEA, which is not returnable.

The Directors do not bind themselves to accept the lowest or any Tender.

Company's Offices:
25, Buckingham Palace-road, Westminster, S.W. 1. 9935

PUBLIC NOTICES

Alton Urban District Council.
WATERWORKS.
PUMPING MACHINERY.

The Council are prepared to receive TENDERS for the REMOVAL and DISPOSAL of EXISTING PLANT, the PROVISION of TEMPORARY PLANT, and the SUPPLY and ERECTION of NEW PUMPING PLANT, with other ancillary work, at the Waterworks Pumping Station, Windmill Hill, Alton, Hants.

The New Plant comprises Two Sets of Crude Oil Engines (which must be of a type convertible to suction gas) and Turbine, or other Well Pumps, together with Accessory Plant.

The specification may be seen and copies obtained with form of Tender at the offices of the Consulting Engineers, Messrs. H. Rofe and Son, MM. Inst. C.E., 208, Abbey House, Victoria-street, Westminster, S.W. 1, upon the payment (by cheque) of the sum of Five Guineas, which will be returned only after the receipt of a bona fide Tender.

Tenders to be sent to the undersigned on or before Twelve o'clock Noon of Friday, November 23rd, 1928, endorsed "Tender for Pumping Machinery."

The acceptance of a Tender will be subject to the approval of the Ministry of Health, and the Council do not bind themselves to accept the lowest or any Tender.

W. BRADLY TRIMMER,
Clerk to the Council.

The Town Hall, Alton, Hants, October 23rd, 1928. 9883

Bengal-Nagpur Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for:—

(F) 1000 LAMINATED BEARING SPRINGS.
(G) 10,000 YARDS WATERPROOF CANVAS.
(H) 26 COPPER FIRE-BOX PLATES.

Specifications and forms of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after Friday, 19th October, 1928.

A fee of 10s. will be charged for each specification, which is NOT returnable.

Tenders must be submitted not later than Noon on Thursday, 1st November, 1928.

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the orders.

By Order of the Board,
E. C. VOLKERS,
9894 Secretary.

Staffordshire Potteries Water BOARD.
CRESSWELL WORKS.
PUMPING PLANT.

The Board is prepared to receive TENDERS for the SUPPLY of TWO DIRECT-ACTING, ROTATIVE, VERTICAL, TRIPLE-EXPANSION, SURFACE-CONDENSING STEAM ENGINES, with Reciprocating Bore-hole and High-lift Pumps, Boilers, &c., complete, each set to be capable of raising two million gallons per day against a head of 440ft.

Specification and form of Tender may be obtained at my office on payment of £5, which will be returned on receipt of bona fide Tender.

Tenders, to be endorsed "Engines," and addressed to "Chairman, Staffordshire Potteries Water Board, Albion-street, Hanley, Stoke-on-Trent," must be received not later than Wednesday, 12th December, 1928.

The Board do not bind themselves to accept the lowest or any Tender.

R. C. FRAIN, M. Inst. C.E.,
Engineer and General Manager.

Albion-street, Hanley, Stoke-on-Trent.
October, 1928. 9930

HAULBOWLINE DOCKYARD.

Machinery and Scrap For Sale.

The Commissioners of Public Works invite TENDERS for the PURCHASE of a large quantity of SURPLUS MACHINERY and SCRAP at Haulbowline.

The property to be sold includes:—

A number of Lathes, Milling Machinery and several Machine Tools suitable for motor car or general engineering work.

A complete Laundry Plant.

A large quantity of Iron and Steel Scrap.

Several large removable Buildings.

Permits to view the material and full particulars of it can be had on application to the undersigned.

Tenders for all or part of the material will be received up to 30th November, 1928.

T. CASSEDY,
Secretary.

Office of Public Works, Dublin, 11th October, 1928.
5/A. 463 9830 W.H. Co.

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PUBLIC NOTICES

Assistant Electrical Engineer
FOR INDIAN STATE RAILWAYS.

REQUIRED for service on Indian State Railways, AN ASSISTANT ELECTRICAL ENGINEER.

Age from 25 to 35 years.

QUALIFICATIONS.—Applicants must have had a good general and technical education, and preference will be given to one who holds a recognised Engineering Degree. In addition, they must have served a regular apprenticeship or pupilage of not less than 3 years in an Electrical Engineering Works, with subsequent experience as an Assistant Engineer.

SALARY.—The initial pay will be from Rupees 375 plus Rs. 150 overseas allowance to Rs. 575 plus £15 overseas allowance, per calendar month, according to age and qualifications, with increases according to the rules in force. Overseas pay is admissible only to an officer of non-Asiatic domicile.

Leave, Provident Fund and gratuity in accordance with the rules applicable to officers of Indian State Railways.

The appointment is for three years in the first instance, but is extensible on mutual agreement. A free first-class passage to India will be provided.

The selected candidate will be required to pass a strict medical examination before appointment.

Applicants must give age and say whether married (with particulars of family, if any) or unmarried. They must also give details of their education, training and subsequent experience, with names of companies or firms by whom they have been employed, and dates of such employment. If previously employed abroad, COPIES of service certificates MUST be forwarded, and reasons for leaving given.

Applications, in writing, enclosing COPIES ONLY of testimonials, must be addressed to the undersigned not later than the 3rd November, 1928.

RENDEL, PALMER & TRITTON,
9913 12/15, Dartmouth-street, London, S.W. 1.

Borough of Brackley.
The Town Council invite APPLICATIONS for the POST of WATERWORKS MANAGER. Salary £3 per week. Particulars and terms of appointment can be obtained from

C. E. BARNES,
Town Clerk.

Brackley, Northants,
19th October, 1928. 9884

Egyptian Government.
MINISTRY OF COMMUNICATIONS,
TELEGRAPH AND TELEPHONES ADMINISTRATION.

ONE ASSISTANT EXCHANGE ENGINEER and TWO EXCHANGE ELECTRICIANS are REQUIRED by the above Administration.

ASSISTANT EXCHANGE ENGINEER.—Age between 28 and 40 years. Should have theoretical and practical knowledge of installation and maintenance of Magneto, Common Battery Manual and Automatic Telephone Exchanges and be conversant with Junction and Trunk Circuits, Power Plant and Accumulators, Testing and Localisation of Line and Instrument Faults. Educational qualifications should be such that he is capable of assisting in the preparation of technical reports and specifications.

His duties would be to assist the Exchange Engineer.

Salary offered is £E800 p.a., and the contract is for three years.

TWO EXCHANGE ELECTRICIANS.—Age between 28 and 40 years.

The qualifications required are similar to those detailed above for Assistant Exchange Engineer, but in a lesser degree.

Their duties would consist of the maintenance of Telephone Exchanges and assistance in the design of Exchanges.

The salaries offered are £E600 p.a., and the contracts are for three years.

The appointments are subject to strict medical examination and to confirmation by the Ministry concerned.

The selected candidates will be granted a transfer allowance equal to one month's salary for change of residence from England to Egypt.

Third-class fares and reasonable out-of-pocket expenses will be paid to applicants who are requested to attend for interview and/or medical examination.

Application form (No. 47) and specimen contract form may be obtained upon request to the

CHIEF INSPECTING ENGINEER,
Egyptian Government,
41, Tothill-street, London, S.W. 1,

to whom they should be returned, accompanied by full particulars as to education, qualifications, previous experience, personal references, and COPIES of certificates and testimonials. 9891

Indian State Railways.
GREAT INDIAN PENINSULA RAILWAY.

TWO POWER STATION CHARGE ENGINEERS are REQUIRED for service on the above Railway. Only British subjects are eligible. The Power Station is situated at Kalyan, about 30 miles from Bombay. The equipment of the Station comprises four 10,000 kW turbo-alternator sets and six Babcock and Wilcox water-tube coal-fired boilers, each of a maximum capacity of 105,000 lbs. of steam per hour. Oil fuel equipment is also installed. Candidates must have held a similar post in a modern power station.

SALARY.—The salary paid will depend upon candidates' age and qualifications and will be not less than Rs. 525 per mensem, rising to Rs. 1375 per mensem, including allowances. Salary will be payable from the date of landing in India, subject to rules in force.

The appointment is for three years, but is extensible on mutual agreement.

A free first-class passage to India will be provided on appointment.

The selected candidate will be required to pass a strict medical examination, and should be preferably not more than 38 years of age.

Application must be made by letter only and all applicants should state their age, salary required, whether married or single, and give full details of their education and career to date.

Applications, accompanied by copies only of testimonials, should be addressed to the undersigned not later than the 31st October, 1928.

MERZ & PARTNERS,
32, Victoria-street, London, S.W. 1.
9877

Indian State Railways.
GREAT INDIAN PENINSULA RAILWAY.

THREE BOILER-HOUSE CHARGE ENGINEERS are REQUIRED for service on the above Railway. Only British subjects are eligible. The Power Station is situated at Kalyan, about 30 miles from Bombay. The equipment of the station comprises four 10,000 kW turbo-alternator sets and six Babcock and Wilcox water-tube and coal-fired boilers, each of a maximum capacity of 105,000 lbs. of steam per hour. Oil fuel equipment is also installed. Candidates must have had experience in the economic combustion of coal and in the running of a modern power station boiler-house.

SALARY.—The salary paid will depend upon candidates' age and qualifications and will be not less than Rs. 525 per mensem, rising to Rs. 1375 per mensem, including allowances. Salary will be payable from the date of landing in India, subject to rules in force.

The appointment is for three years, but is extensible on mutual agreement.

A free first-class passage to India will be provided on appointment.

The selected candidates will be required to pass a strict medical examination, and should be preferably not more than 38 years of age.

Application must be made by letter only, and all applicants should state their age, whether married or single, salary required, and give full details of their education and career to date.

Applications, accompanied by copies only of testimonials, should be addressed to the undersigned not later than 31st October, 1928.

MERZ & PARTNERS,
9878 32, Victoria-street, London, S.W. 1.

CHAPMAN & HALL'S BOOKS

JUST PUBLISHED

The Second Volume of

CONCRETE
PLAIN AND REINFORCED
The Theory and Design of Continuous Beams, Frames, Building Frames and Arches

By The Late FREDERICK W. TAYLOR, SANFORD E. THOMPSON and EDWARD SMULSKI.

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This second volume consists of entirely new material not contained in the previous editions of this book. It is adapted as well for use by the practising engineer as for a text-book for students of engineering. As far as it is known to the authors, this is the first book in any language in which the subject of statically indeterminate structures has been fully treated, both from a theoretical and practical standpoint. Numerous original formulas are given for the easy use in the design of continuous beams, frames and arches.

Volume I.

Theory and Design of Concrete and Reinforced Structures. 969 pages. 40s. net.

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Essays for English. Selected and Edited by RAY PALMER BAKER, Ph. D., Professor of English and Head of the Department of Arts, Science and Business Administration, Rensselaer Polytechnic Institute. 235 pages. 10s. net. Dr. Baker has made an excellent selection, and has included only those authors who have something to say and who say it well. The authors selected are men who have achieved prominence, either as educators, engineers or scientists. The subjects discussed are those of immediate interest and the conclusions reached are such as to attract and interest the student. It is believed that this book will do much to stimulate the student to think and express his ideas in an effective manner.

MECHANICAL ENGINEERING

A Text-Book for a Short Course. By Lieut.-Colonel W. A. MITCHELL, U.S. Army. Prof. of Military Engineering, U.S. Military Academy. 410 pages. Demy 8vo. 20s. net. Every army officer must have fair working knowledge of the principles and practice of mechanical engineering; he applies this in his work on army posts in time of peace, and with motor vehicles and shop machinery in time of war. In this book the cadet is taught enough of the branches of mechanical engineering so that he may in future understand the practical mechanical engineering requirements of his profession.

Detailed Prospectuses free on request to Dept. E. 6.

CHAPMAN & HALL, LTD., 11, HENRIETTA ST., W.C. 2.

PUBLIC NOTICES

Hong Kong Electric Co., Ltd.
Messrs. Preece, Cardew and Rider have received instructions from the Hong Kong Electric Co., Ltd., to obtain APPLICATIONS for the APPOINTMENT of ENGINEER and MANAGER to the above Company.

The first agreement will be for three years and the proposed salary is Hong Kong 2000 dollars per month, with free quarters and certain other privileges.

Pending the retirement of the present Engineer and Manager in 1930, the Engineer appointed will act as Deputy Engineer and Manager on full salary.

A proportion of the Manager's salary is retained and invested in a Provident Fund to which the Company also contribute.

Candidates must have had good technical education and sound experience in power station operation, in distribution, and in the management of electricity supply undertakings.

Previous experience in the development of electricity undertakings overseas would be an advantage.

Age should not exceed 40 years.

Applications, giving full particulars of education, training and experience, together with not more than three copies of recent testimonials or references, should be sent to Messrs. PREECE, CARDEW and RIDER, 8, Queen Anne's-gate, Westminster, S.W. 1, not later than November 15th, 1928.

Messrs. Preece, Cardew and Rider prefer that candidates should content themselves with their application and the names of their references. Personal letters to partners are not necessary. If a candidate is placed on the short list the references will be taken up. 9897

JOHN HOLLOWAY, M.I. Mech. I.,
Sentinel House, Southampton Row, LONDON, W.C.1.
Specialist in WORKS LAY-OUT, EQUIPMENT & ORGANISATION
Contracts recently completed, include :—
Messrs. BROOM & WADE, Ltd., High Wycombe.
Messrs. HUNTER-PENROSE, Ltd., London and Wellingborough, etc. P 5114

SITUATIONS OPEN
COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED

WANTED, a GENERAL MANAGER for Structural Engineering Company (British) in Calcutta. The applicant must be a Structural Engineer with previous similar experience, including Works. The post gives excellent prospects, and remuneration depends on qualifications. Agreement for five years. Age 30 to 38 years.—Apply in writing with copies of testimonials to Z.L. 780, care of Deacon's, Fenchurch-avenue, London. All applications will be treated as strictly confidential. 9873 A

WANTED, ASSISTANT SUPERINTENDENT for large works engaged on light mass production. Successful executive experience as well as good practical knowledge of tools and methods necessary.—Address reply to "EXECUTIVE," Wm. Porteous and Co., Advertising Agents, Glasgow. P5111 A

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For continuation of Small Advertisements see page 4.

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A Seven-Day Journal

King's College, London.

University College, Gower-street, London, was opened in October, 1828, to provide in the Metropolis a university for persons of all religious denominations. Its foundation was preceded by a fruitless attempt to induce the Universities of Oxford and Cambridge to relax their theological tests and otherwise to bring themselves into line with current requirements. Many people, however, objected to the total exclusion of religion from the curriculum. In September, 1829, work was begun on another college, King's College, on a site adjoining Somerset House in the Strand, in the curriculum of which theological instruction and religious discipline were to form parts. In 1836 the "University of London" was constituted under Royal Charter. It was in those days merely an examining body, empowered to grant degrees to pupils of University College and King's College. Subsequently, its examinations were thrown open to the whole world. In 1900 the University was reconstructed with an external side, continuing the work of world-wide examinations, and an internal side including the two colleges and some thirty other educational institutions concerned with higher education in the Metropolis. Next year King's College will celebrate its centenary, and in connection therewith is now issuing an appeal for £350,000 to enlarge the College and to provide certain much-needed endowments. Of the total required, about £100,000 is needed to endow special Chairs and studentships in physics, physical chemistry, electrical engineering and physiology. A sum of £125,000 is required for the rebuilding of the south-east block of the College, which extension will, among other ends, provide new and urgently needed accommodation for the Department of Chemistry.

German Armoured Ships.

The construction of the first armoured ship for the post-war German Navy, in regard to which there has been so much political controversy, would now seem to be assured. In August last the Federal Council resolved, by unanimous vote, that the vessel should be built, and in the same month the contract for the hull and engines was placed with the Deutsche Werke A.G., at Kiel. In September the German Communist party demanded a national plebiscite on the question of building this vessel or any further fighting ships. Under the German Constitution, a preliminary ballot must be taken before such a referendum is instituted, and 4,000,000 votes are required as a minimum in the first instance. The ballot, however, produced only 2,000,000 votes, the inference being either that the nation as a whole favours the construction of the ships, or that it remains indifferent to the subject. In the meantime, we understand, the keel of the first ship has been laid at Kiel. Until her launch she is to be known as the "Ersatz Preussen." It is confirmed that she will have a normal displacement of 10,000 tons, be propelled by Diesel engines of a type specially evolved by the German Admiralty, and carry a main armament of six 11in. guns. In the construction of the hull electric welding is to be employed instead of rivets Further authentic details have not yet been received, but according to the German Press the ship will have no funnel and will be so well protected by armour plating, subdivision, and bulges as to be capable of resisting more punishment than any warship now afloat. It is proposed to build three more ships in order to obtain a homogeneous squadron The estimated cost is £4,000,000 per ship.

Thames Floods.

The principal decision arrived at last March by a committee appointed by certain Thames-side public authorities to enquire into the question of floods from the river Thames within the County of London, was that the whole subject required farther expert investigation and that that investigation should be undertaken by the Liverpool Tidal Institute. The committee, it may be recalled, was appointed at a conference following the disastrous flooding which occurred on January 6th–7th, 1928. The report of the Tidal Institute's investigations has now been received and discussed by the London County Council, the Port of London Authority, and the Ministry of Health. Its most interesting feature is the revelation of the fact that the chief cause of excessive flooding in the Thames is the building up of a storm surge in the northern part of the North Sea which, travelling slowly round our coasts and increasing in magnitude, happens to enter the mouth of the Thames coincidently with the occurrence of normal high tide. At 3 p.m. on January 6th this year the winds raised the sea level at Dunbar by nearly 2ft. above the normal. Eight hours later, at 11 p.m., the surge had reached Southend and had become increased to 5ft. above the normal level. The meteorological conditions required for the creation of a southward travelling surge appear to be a strong westerly wind rising suddenly over the upper part of the North Sea and veering quickly to the north-west and north. A strong westerly wind, which does not veer, is apparently not dangerous. It is calculated that if the defences are raised 6in. the frequency of the occurrence of flooding would be reduced to once in 120 or 180 years, while if they were raised 12in. the frequency would become once in 240 or 540 years. It is possible, it is stated, to forecast the occurrence of large surges, but it is not as yet possible to forecast the time of their arrival at Southend, and therefore to state definitely whether they will coincide with normal high tide.

Railway Economies.

More attention than it apparently deserves has been paid to a laconic announcement issued by the London, Midland and Scottish, and the Great Western Railways this week to the effect that various agreements existing between the two companies for dealing with passenger and freight working over parts of the lines where the systems touch, are now being developed to meet the changing conditions. The important points of contact are on the Birmingham–Bristol, Birmingham–London, and Chester–Warrington lines, and it is learned that the extended agreements will be mainly concerned with the time-tables of passenger and goods trains. A matter of greater public significance is in all probability the announcement by the Great Western Railway that on Monday of next week it will put into operation a long-distance combined road and rail service between Cheltenham and Paddington. The journey between Cheltenham and Oxford will be performed by road and between Oxford and Paddington by rail. Four daily and two Sunday services will be run each way. The road service will be operated by six-cylinder Thornycroft all-weather-body cars, timed to do the forty miles between Cheltenham and Oxford in about two hours. No intermediate stops will be made by the cars. The combined fares between Cheltenham and London will be 12s. single and 15s. return third-class, as compared with 14s. 4d. single and 28s. 8d. return third-class by rail throughout. There will therefore be a saving of 2s. 4d. on the single and 13s. 8d. on the return ticket.

The Late Mr. Robert Traill.

The death of Mr. Robert Traill, which took place at his home in Glasgow last week, will be widely regretted in shipbuilding and marine engineering circles, both on the Clyde and Tyne and in Belfast. Mr. Traill began his career in 1884 as an engineering apprentice at the works of the Wallsend Slipway and Engineering Company, Ltd. After completing his apprenticeship, he spent some time at sea and was appointed in 1892 as assistant to the manager at the works of the Wallsend Slipway Company. He was given a seat on the board of the company in 1915, which position he held until 1920, when he retired to become manager of the engine works and director of the Fairfield Shipbuilding and Engineering Company, Ltd., Govan. At the same time he also became associated with Workman, Clark and Co., Ltd., of Belfast. His work at the Fairfield yards will always be associated with the design and construction of the machinery of the quadruple-screw motor liner "Aorangi." When that vessel was ordered by the Union Steamship Company of New Zealand in 1922, it was due in a large measure to Mr. Traill's bold conception and breadth of view that the design was carried through. Excellent results have been attained, of which Mr. Traill was always justly proud. In many ways the "Aorangi" may be looked upon as a pioneer among large motor vessels, for she has influenced the further use of marine oil engines for the propulsion of both passenger and cargo carrying ships. At the beginning of this year Mr. Traill resigned his position with the Fairfield Company in order to take up a directorship of Swan, Hunter and Wigham Richardson and Co., Ltd., of Wallsend-on-Tyne, which firm has large allied interests on the Clyde.

The Shipbuilding Employers' Federation.

At the annual general meeting of the Central Board of the Shipbuilding Employers' Federation, which took place in Edinburgh on Friday last, October 19th, Mr. A. J. Campbell, of William Beardmore and Co., Ltd., Dalmuir, was elected President for the ensuing year. Mr. Campbell, who has been a Vice-president of the Federation since 1924, and who is also a past chairman of the Clyde Shipbuilders' Association, succeeds Mr. J. T. Batey, of Hawthorn, Leslie and Co., Ltd., Hebburn-on-Tyne. The re-elected Vice-presidents included Mr. J. H. Edwards, of the Middle Docks and Engineering Company, Ltd., South Shields, and Mr. A. L. Ayre, of the Burntisland Shipbuilding Company, Ltd. Mr. R. A. Green, of R. and H. Green and Silley, Weir, Ltd., of London, was also elected a Vice-president in order to fill the vacancy caused by the election of Mr. Campbell as President. Another appointment was the election of Mr. G. W. Barr, of Vickers-Armstrong's, Ltd., Barrow-in-Furness, as chairman of the Conference and Works Board of the Federation, in place of Mr. W. A. Henderson, who has retired, with Mr. G. H. Stafford, of Earle's Shipbuilding and Engineering Company, Ltd., Hull, as vice-chairman. The new officers of the Federation are representative of the various shipbuilding and ship-repairing firms in the country, and they have all brought, and will bring, both knowledge and long experience towards the solution of the difficulties with which the shipbuilding industry is faced. It is of interest to note that Mr. G. W. Barr, the new chairman of the Conference and Works Board, is the son of Mr. John Barr, who presided over the Federation during the period of the Joint Committee of Inquiry.

Cobden Bridge, Southampton.

The new Cobden Bridge over the Itchen at Southampton was formally opened for service by the Minister of Transport—Lieut.-Colonel the Right Hon. Wilfrid Ashley—yesterday, October 25th. The new structure replaces an old wrought iron girder bridge, the building of which was begun in 1881. It is of reinforced concrete and comprises five arch spans, each of 75ft. The bridge is—apart from its engineering features—of interest because it, with another bridge at Woodmill, provides the only means by which free access to Southampton from the eastwards across the Itchen may be had. There are two other ways by which the general public can cross the river, namely, by the Northam Bridge and by the Itchen Floating Bridge. Both of them are, however, private property and tolls have to be paid. The replaced bridge was built by the National Liberal Land Company shortly after it had acquired the Bitterne Park Estate, and it was thrown open and dedicated to the free use of the public for ever by Mr. James E. Thorold Rogers, the chairman of the Land Company, in June, 1883, the then Mayor acknowledging the gift. The new bridge is also to be toll-free.

New Gas Plant at Glasgow.

Yesterday, Thursday, October 25th, the new carbonising plant at the Dawsholm Gasworks of the Glasgow Corporation was officially brought into use. It incorporates the latest practice, and is reported to be one of the most comprehensive installations of its kind in Great Britain. There are two benches of twenty-two Woodall-Duckham continuous vertical retorts and two benches of twenty-four Woodall-Duckham intermittent vertical retorts having a combined carbonising capacity of 587 tons of coal per day. The designed output of the retorts is 9,000,000 cubic feet of 475 B.Th.U.'s gas per day. The retorts are heated by a mixture of producer gas and air, which is passed downwards in chambers arranged at each side of the retort. The parts exposed to heat are constructed of high grade silica. The temperature at the top of the chambers is about 1400 deg. Cent., and about 1100 deg. Cent. at the bottom. Special machinery has been installed for the washing, breaking and grading of the coal before it goes to the retorts. All the material over 1in. is supplied to the continuous retorts, and that under 1in. to the intermittent retorts, which work in conjunction with a Sulzer dry coke-cooling plant. The dry coke from this plant is to be made available for sale, and is stated to be of a superior quality. The coke produced from the continuous retorts will be mainly employed in the producers. The flue gases from the retorts are to be utilised to raise steam in waste heat boilers, of which there are three, having a total steam raising capacity of over 28,000 lb. per hour.

The Royal Commission on Transport.

A preliminary meeting of the members of the Royal Commission on Transport was held on Thursday of last week, October 18th, to consider the Commission's terms of reference and the scope of the inquiry with which it has been charged. The Commission has been constituted to consider problems arising out of the growth of road traffic and to consider and report upon what measures should be adopted for the better regulation and control of the available means of transport in Great Britain, including transport by sea coastwise and by ferries, with the object of promoting their co-ordinated working and development to the greatest public advantage. Responsible bodies and persons are invited by the Commission to transmit to it statements and suggestions upon the subjects covered by the Commission's terms of reference. Information is particularly invited on the practicability of increasing the effectiveness of each of the available means of transport, on the extent to which co-ordination is practicable, on the disabilities of any particular means of transport, on the regulation of transport by road, and on the directions in which public safety and convenience can be promoted. The first public meeting of the Commission will be held in London on Wednesday, November 14th, and will be devoted to the consideration of evidence from the Ministry of Transport.

Television.

An official reply has been given by the Baird Television Development Company to the statement issued by the British Broadcasting Corporation announcing its decision not to undertake for the present the experimental transmission of television from a B.B.C. Station. The company contends that the Baird system has now reached a stage of technical advancement which, in the opinion of many independent authorities, renders it fit for a public service. The decision of the B.B.C., the company states, is contrary to the opinion of many independent engineers, including those of the Post Office. The company is taking steps to secure independent broadcasting facilities for television.

The No. 3 Lister Drive Power Station.

No. II.*

THE three new boilers, each with a normal evaporative capacity of 125,000 lb. per hour and an overload capacity of 156,250 lb., are being supplied by Babcock and Wilcox, Ltd., and they will feed into one of the existing steam receivers in the station. They are of the C.T.M. pattern—see Fig. 13—with vertical headers, interdeck superheaters, steel tube economisers and air heaters. They are designed for pulverised coal firing and the installation embodies interesting features, some of which are new in this country, although they have been extensively used in the United States by the Fuller Lehigh Company, which is associated with Babcock and Wilcox, Ltd. The combustion chambers are entirely lined with water tubes which are protected by Bailey blocks. The pulverising plant is of the Unit type, and there will be four Alfred Herbert Atritors per boiler. Each will feed a Calumet burner with a long narrow opening, as shown in Figs. 14 and 16, and the mixture of coal and air will be fed into

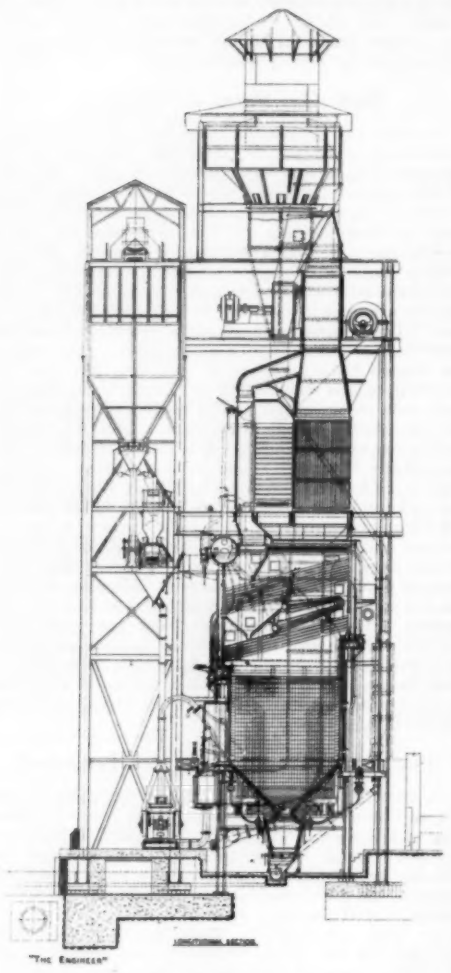


FIG. 13—SECTION THROUGH BOILER

the combustion chambers between the adjacent tubes of the Bailey block wall. From the bunkers the coal will pass through an Avery automatic weigher, thence through a coal crusher direct to the Atritors. There will be one weigher and one crusher for each boiler, and either of them can be by-passed when necessary. With this type of plant all the drying takes place inside the Atritors and is done by means of air heated by hot gases drawn from the boiler uptake duct or the combustion chamber.

The Bailey water-cooled furnaces—see Figs. 17 and 18—that are being fitted to these new boilers will withstand the severe furnace conditions arising from the high combustion rates which are made possible by the turbulent burning of pulverised fuel. From the point of view of combustion alone, high furnace temperature and hot refractory walls are desirable. It is only the damaging effect of molten ash from the coal that necessitates the reduction of temperature of the furnace walls to a point at or below the fusion temperature of the ash. The tendency to-day is to employ water-cooling tubes which form part of the circulating system of the boiler, in order to effect cooling of the furnace walls and furnace bottom. The nature of the water-cooling system should, however, be chosen with discretion. The conclusion which Messrs. Babcock and Wilcox have arrived at is that the only way of permanently resisting the fluxing action of the molten ash is to reduce the temperature of the wall by absorbing heat at such a rate that a film of solidified ash will remain upon it. In order to maintain efficient combustion, however, the temperature of the wall should not fall below that necessary to provide for the solidification of the ash, and that is achieved by the construction employed in the Bailey furnace wall in which refractory faced blocks are clamped on the furnace side of the water tubes, as shown in Fig. 18. This construction with Calumet burners, as shown in Figs. 14–16, gives a completely water-cooled furnace on all four sides and on the hopper bottom. Low maintenance cost and ash-removal facilities are important features of the installation. The blocks consist of a heavy cast iron body having a refractory face, as shown on the right of Fig. 19. In casting the blocks, a burned refractory tile is placed like a core into a mould and the iron is cast on to it. The blocks are machined to close limits to fit the tubes to which they are tightly clamped in the manner shown in Fig. 18, with a plastic heat-conducting bond between the blocks and tubes, and efficient thermal conductivity is thus established. Bare iron blocks, as shown on the left of Fig. 19, are used for the portions of the combustion chamber where the temperature is not excessive, such as the ash hopper above the point A on Fig. 20.

As far as this country is concerned, the ash-removing plant associated with the new boilers is quite novel, although it has been in operation in America for a considerable time. It is known as the "Hydrojet" system, and it is being supplied by the Allen-Sherman Hoff Company, of Philadelphia, which is acting as sub-contractor to Babcock and Wilcox, Ltd., the main contractors for the boilers and pulverised coal plant. Below each boiler there is a hopper, as shown at A, Fig. 20, in which the ashes from the boilers are accumulated, after they have been quenched by nozzles fixed at the top of the hopper, as shown. When the fireman desires to empty the hoppers, pumps are set into operation for supplying water to the feed-plate nozzles and to

FIG. 14—TYPICAL CALUMET BURNER

nozzles in the culvert B below the hoppers, and the ash gateways between the hoppers and culvert are then opened. The ashes are then sluiced into the culvert, and are carried forward by the water jets to a sump from which they may be removed by a grab. The water that propels the ashes through the culvert is pumped through the nozzles by a motor-driven pump, having a cast steel impeller especially designed for the purpose, the same water being continually circulated through the system.

Cooling towers of the type in use at the No. 3 Lister Drive power station are being employed at the new Hams Hall station at Birmingham, Freemans Meadows station at Leicester, and the Longford station at Coventry, but at the time they were put into service at Liverpool they were practically unknown in this country. They were originated in Holland, where they have apparently proved a marked success. The shells—see Fig. 22—are of reinforced concrete, whilst the internal stacks over which the water falls are made of timber. Five of these towers will serve for the two 25,000-kilowatt generating units. Each tower, which is 118ft. high and 100ft. in diameter at the base, tapers to 42ft. at about three-quarters of the height and opens out to a diameter of 49ft. at the top. The total cooling capacity of the five towers is 3,000,000 gallons per hour. After it has been cooled, the water is led into a culvert to which the circulating pump suction pipes are connected. Each tower can be shut off individually for cleaning purposes, and arrangements have been made for measuring the

FIG. 15—CALUMET BURNER—OUTSIDE VIEW

quantity of water. Normally, the water is discharged through a 4ft. circular hole in the bottom of the outlet duct, and when it is necessary to shut off a tower, this hole can be closed by lowering a plug, as shown in Fig. 21, this plug being wedged down on to its seating. The plug is also used when it is desired to measure the water, for, if it is made to cover the hole whilst the tower remains in operation, the water in the pan of the tower rises and flows over

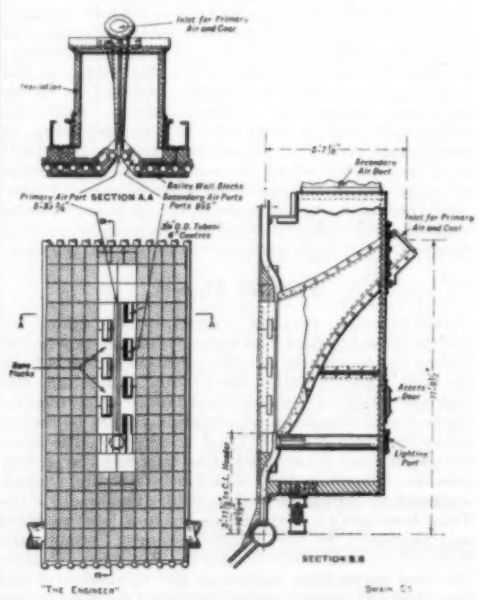


FIG. 16—DETAILS OF TYPICAL CALUMET BURNER

a measuring notch in the manner indicated, in this case the head of water holding down the plug. For sealing the outlet pipes from the suction culverts, similar plugs are employed. The towers were guaranteed to cool 470,000 gallons of water per hour from 102·5 deg. to 83 deg. Fah., with the atmospheric wet bulb temperature at 55 deg. Fah. Not only was this performance readily obtained, but the towers will handle up to 625,000 gallons per hour without interfering with the evenness of distribution. These reinforced concrete towers require no upkeep as far as the shell is concerned, the shell being practically

No. I. appeared October 19th.

indestructible and fireproof, and it may be made as high as desired. The great strength of the shell enables it to resist the most severe storms. The hyperbolic

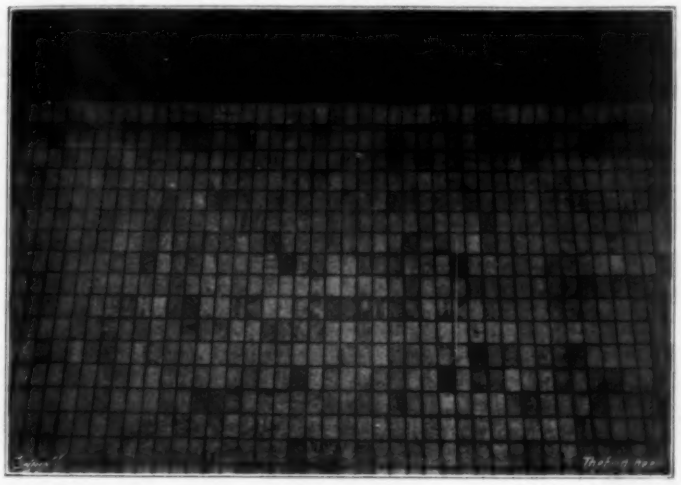


FIG. 17—BAILEY FURNACE—INSIDE VIEW

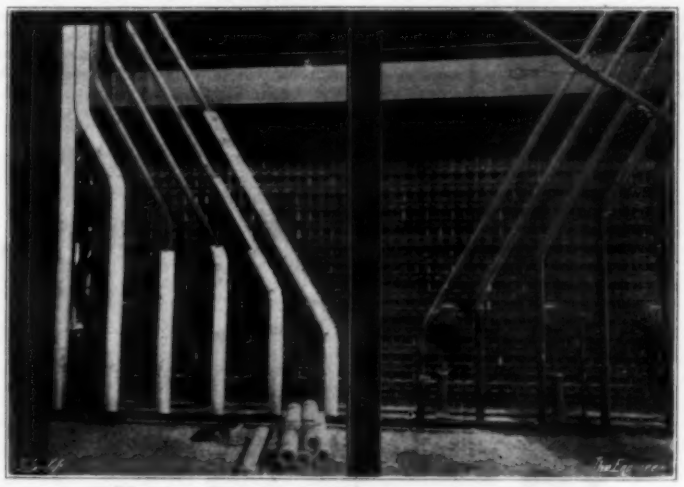


FIG. 18—BAILEY FURNACE—OUTSIDE VIEW

shape automatically directs the air streams entering the tower towards the centre part, and induces an excellent draught, whilst the widening out of the top part

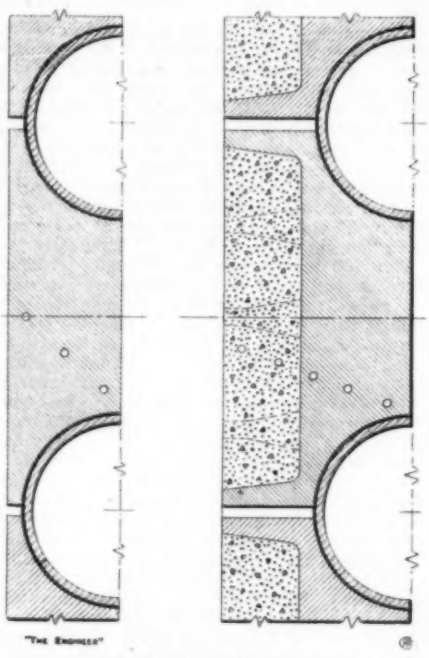


FIG. 19—BAILEY BLOCKS

reduces the speed of the column of air saturated with steam, prevents eddies around the cornice, and permits the recuperation of a certain quantity of the water

of louvres, such as are necessary in other types of towers, and which obstruct the ingress of air.

The first turbine is fitted with a condenser manufactured by G. and J. Weir, and the second with a central flow condenser manufactured by the Metropolitan-Vickers Electrical Company. In each case the condenser is designed to maintain a vacuum of 27·5in. at the turbine exhaust flange, with the barometer at 30in. Each condenser naturally embodies the manufacturers' special features of design, but many of the characteristics which were specified by the Liverpool Corporation are common to both, such as (*a*) duplicated circulating water pumps, one driven by an alternating-current motor and the other by a direct-current motor. Under normal working conditions, the alternating-current motor driven pump will supply 60 per cent. of the circulating water, and the direct-current pump 40 per cent. At times of reduced load the direct-current pump working alone is able to supply continuously 60 per cent. of the normal quantity of water, and, in addition, is capable of working at such an overload as to supply 75 per cent. of the normal quantity of water for a period of two hours. (*b*) Duplication of the extraction pumps, one driven by an alternating current motor and one direct current. (*c*) The provision of bled steam and other feed heaters. (*d*) The use of three steam-operated air ejectors, two serving for normal operation and the third serving as a standby. (*e*) The use of an evaporator taking low-pressure steam from the turbine and returning the evaporated steam to the condenser. Weir evaporators have been provided for both sets. They are of the horizontal type and have a total heating surface of 480 square feet, while each evaporator is capable of evaporating 13,300 lb. of make-up water per hour, when supplied with 15,000 lb. of steam per hour bled from the main turbine at a pressure of 5 lb. per square inch absolute. To the evaporator shell is fitted an automatic feed-water regulator, so that the level inside the evaporator may be automatically maintained constant. A small sludge pump, with a capacity of 100 gallons per hour, removes the residue of the raw water as required.

Views of the condensers and auxiliaries belonging

with the barometer at 30in., when supplied with 23,200 gallons of cooling water per minute at a temperature of 83 deg. Fah. It has a cooling surface of 37,800 square feet, made up of 9400 Bemal metal tubes, each ¾in. outside diameter and 18 S.W.G. thick. The length between the tube plates is 20ft. 6in. The cast iron shell is bolted directly to the turbine exhaust flange and the disposition of weight and expansion are arranged for by spring supports under the condenser feet. As we have said, the central flow construction, developed by the Metropolitan-Vickers

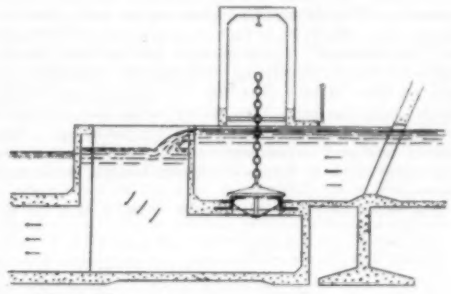


FIG. 21—MEASURING CIRCULATING WATER

Company, has been adopted and, as will be seen from the drawing Fig. 23, the tube plate has a smaller diameter than the shell, thereby allowing the steam to enter the nest of tubes over the whole periphery and to flow radially inward towards the centre. The air is drawn off at the centre instead of at the bottom, as in the old straight-flow type of condenser. Owing to the comparatively short distance which the stream has to traverse from the periphery to the centre the pressure drop is very small, and that, together with the central system of air withdrawal, which gives freedom from baffling, results in high rates of heat

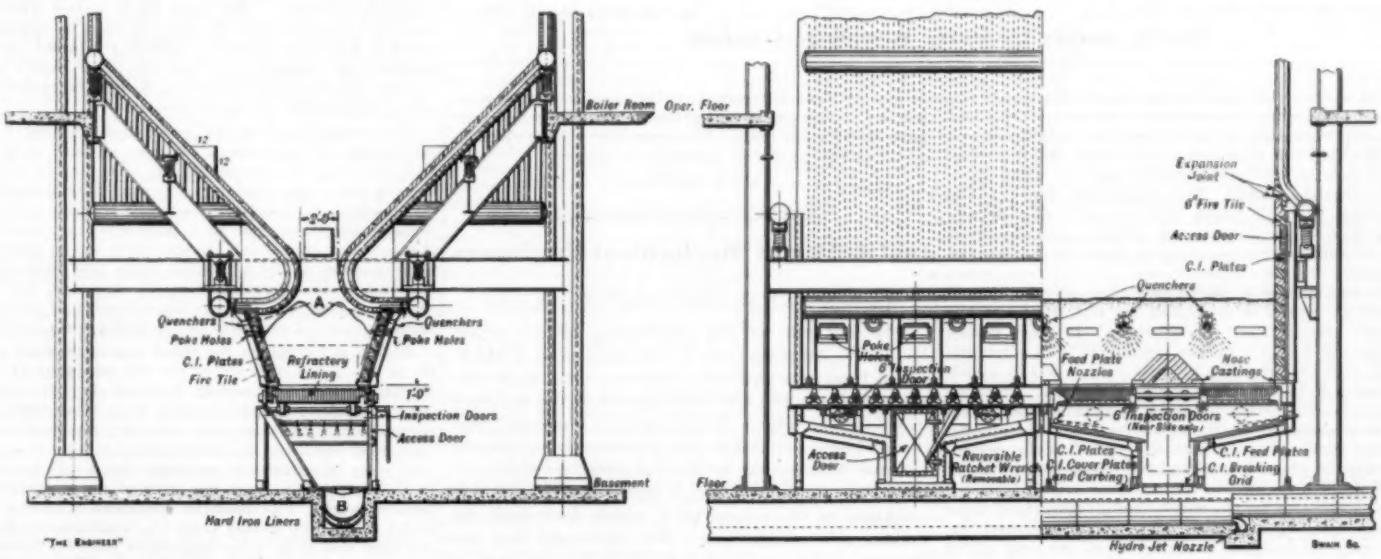


FIG. 20—"HYDRO-JET" ASH-HANDLING PLANT

otherwise lost through evaporation. The spreading out of the lower part of the shell causes the water drops always to fall in the pond without the provision

to the sets are given in Figs. 24 and 25 on page 460. The Weir condenser was fully described in THE ENGINEER of November 5th, 1926. The Metropolitan-

transmission, thus reducing the size of the condenser. Tests made at Liverpool and elsewhere are said to have substantiated the makers' claims with regard

to improved heat transmission. As the steam enters all round the periphery, the condensate falling through, the hot steam, has practically the same temperature as that corresponding to the vacuum. Tests have shown in fact that the difference of temperature in most cases is less than 1 deg. Fah. The practice of withdrawing the air at the centre makes the partial air pressure at the point where the condensate is withdrawn very small and reduces the amount of air which can be carried away by the condensate to a negligible quantity. The de-aerating property of both the condensers is so effective, in fact, that separate de-aerators are unnecessary. Tests carried out by the Metropolitan-Vickers Electrical Company's chemists are said to have shown that the oxygen content of the condensate was nil. Two water boxes are provided, one having double inlet and outlet branches. Two hinged half-end covers are fitted at each end of the condenser with a total of sixteen hinged inspection doors.

The condensate is withdrawn from a well at the bottom of the condenser by means of a Metropolitan-Vickers single-stage extraction pump and a Drysdale lift pump operating in series, and two sets of pumps are provided for alternative use. One set is driven by an alternating-current motor and the other by a direct-current motor. The combined duty of the extraction and lift pump is to extract and deliver 600 gallons of condensate per minute against a total head of 166ft., when running at 1440 revolutions per minute.

The condensate is discharged through two ejector heaters in which it is heated by the whole of the exhaust steam from the ejectors. It then passes through an integral heater embodied in the turbine frame, and a three-valve by-pass is provided to enable the heater to be cut out of service if desired. The condensate is still further heated in a gland heater which acts as a condenser for the steam leak from the glands. A surge tank under vacuum is inserted in the system between the gland heater and the boiler feed pump in the manner described in the previous article.

The apparatus for the removal of air consists of three Metropolitan-Vickers two-stage steam-operated air ejectors, each designed to deal with 50 per cent. of the air leak. These ejectors are arranged on a platform situated between the basement and the turbine floor, and they can be controlled either at the platform or at the turbine floor. Each ejector has two stages in series; the first withdraws the saturated air from the condenser and discharges it at a pressure intermediate between that in the condenser and atmospheric pressure into a cooler of the surface type, in which the first-stage operating steam is condensed and in which the mixture of vapour and air is cooled.

This mixture is withdrawn by the second stage and discharged to atmosphere, the steam being condensed in a second cooler similar to the first. In each stage the condensate is used as the cooling medium. The condensate from the first stage is drained to the condenser through a syphon pipe and that of the second stage to a hot water tank, collecting the drain from the gland heater. The uncondensed vapour and air discharged from the second stage is taken out of the building *viâ* the main atmospheric exhaust pipe. The surface cooler is of the field tube type; the cooling water passes through a strainer and upwards through the small tubes, and returns by way of the annulus between the small and large tubes. With this type of cooler only one header is required, thus eliminating expansion troubles. Each ejector is designed to deal with 67 lb. of dry air per hour when saturated with vapour at the temperature at the ejector suction connection, the steam consumption under these conditions being 750 lb. per hour. The operation of the ejectors is claimed to be stable under all conditions.

(To be continued.)

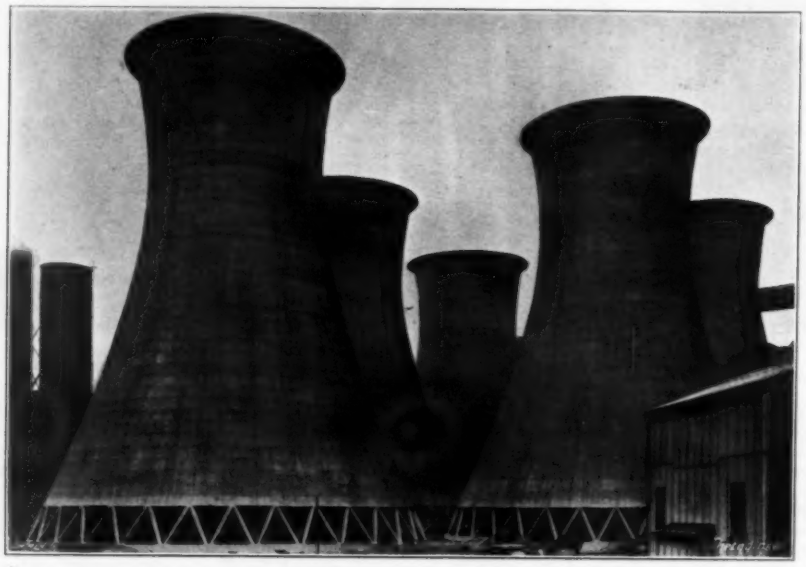


FIG. 22—COOLING TOWERS

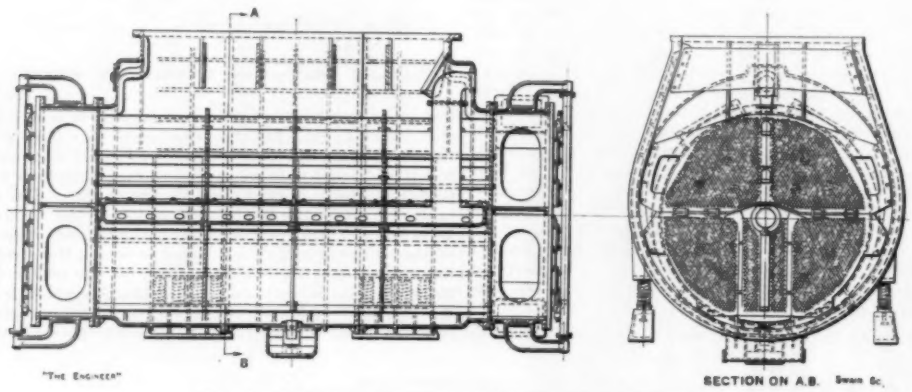


FIG. 23—SURFACE CONDENSER—METROPOLITAN-VICKERS

Institution of Mechanical Engineers

MANAGEMENT AND THE TRAINING OF MEN.

THE first part of the presidential address which Mr. R. W. Allen read before the Institution of Mechanical Engineers on Friday, October 19th, dealt concisely with the rise and development of the auxiliary machinery of ships. It is so closely condensed that it would be impossible to give anything like a valuable abstract of it, and as we are not permitted to reprint the address in full we deem it better to give our whole attention to the second part, which dealt with the human side of industry. We may add that the delivery of this part of the address was punctuated by frequent applause, showing how much the members sympathised with the President's views.

Management.—Side by side with the development of design and the utilisation of new materials there has grown up the new science of management which, by concerning itself with works equipment, the training of men, the proper use of machines, and the introduction of new methods, has enabled us to cope with the requirements of the designers.

The inventive genius of Parsons and Diesel and the improvements in materials effected by metallurgists would have been of little value had not workshop conditions kept pace with the exacting demands made by the new designs and new materials. And in this connection it must be realised that efficient management must take account in equal measure of the training and welfare of men and the proper use of machine tools and machinery generally.

Training of Men.—I therefore propose at this point to say something concerning the human side of industry, and I shall deal in some detail with the question of training. These remarks are the result of my own experience and the views expressed are my personal views. In the early days of engineering there grew up a system of apprenticeship by means of which craftsmen were trained and the arts and secrets of the various trades were transmitted from one generation to the next. To-day we hear it said that apprenticeship is out of date, and there appears to be a growing body of opinion in favour of the substitution of other methods of training for the old-fashioned apprenticeship scheme. Similarly the past forty years has seen a great change in the method of training of engineers as distinct from craftsmen. The college-trained engineer was once a rarity, while to-day it is even suggested that his college training is all that an engineer needs. But however far that suggestion may be from the truth, we do find that the engineer with both college and workshop experience is the normal candidate for the important posts in engineering to-day.

The question of training for all grades in the engineering industry is for us a matter of the profoundest interest. Every enlightened engineering employer realises that the training of young men cannot be undertaken lightly and with motives of exploitation, but is a matter which needs to be put in a paramount place in his organisation and to be administered with vision and foresight if the industry is to recruit and train an adequate supply of men capable of carrying on the engineering traditions which are our heritage.

If I could place side by side with the 21 horse-power electric lighting plant of H.M.S. "Thunderer" and the four 700 horse-power Diesel engine generators which constitute the electric power station of a modern motor vessel, there would be no need to labour the argument that, in spite of all the machine tool aids which modern science has provided, the necessity for training engineers of all types and grades, operatives, craftsmen, inspectors, planners, and administrative officers, is far greater to-day than it ever was before. Such a comparison would be equally effective in demonstrating the necessity for a much broader training, and, especially in the higher ranks, for the development of a type of mind capable of tackling problems on a larger scale and of greater intricacy than those which our forefathers were called upon to solve.

Some such considerations as these have led me to the conclusion that engineering training and education will in the future have three very important and difficult tasks. First there is the problem of providing a suitable training for the higher posts in the industry. Much difference of opinion has always existed, and, I imagine, always will exist as to the relative merits of different systems of training for administrative and managerial positions in engineering. But by whatever course it is achieved, the aspirant to high positions in the engineering world must have acquired a sound knowledge of scientific principles, of the technical applications of those principles, and of the workshop processes involved. He must have served with and learned to understand the type of men he aspires to control, and have gained a sufficiently broad view of industry to enable him to see the other man's point of view, whether the other man be his competitor, his client, his partner, or his employee.

The second problem of industrial training is the production of craftsmen. I have already indicated that the work of the craftsman of to-day is broader than it was some years ago; hence his training must be broader, and I believe that such training can commence with advantage at a later age than sixteen if the boy has continued his schooling up to that age. Continuation of his education from this point up to the end of his apprenticeship is, however, the only assurance that he will have the educational and technical equipment requisite to his duties and position.

And now I come to the third and what may prove to be the most difficult of all the educational tasks to which the engineering industry has to address itself. I refer to the training of boys other than craft apprentices. Hitherto this category has been singularly neglected, but we are realising to-day that from this class of entrant to industry there will be drawn in the future the great majority of the operatives of process work. The machine operators of to-day need to be something better than the machine-minders of the past and there is an important field for investigation as to the best methods of education and training for our semi-skilled and unskilled workers. In this connection I might add that it is essential that there should ever remain open the door of promotion from one grade to another. As engineers it behóves us to remember that George Stephenson commenced at the

very bottom of the social ladder and we must ensure that the ladder of promotion still stands ready for the boy of ability, perseverance, and ambition to climb.

What is needed in the engineering industry to-day is a fuller appreciation of the value of education, not merely as an aid to production, but as an aid to fullness of life and happiness. If we are merely training men to become engineers or craftsmen or machine operators we are performing but a transient service to our day and generation; our aim must be to train men whose characters as well as their engineering achievements shall live after them.

Human Relationships.—My comments on the human side of industry have been chiefly concerned with the paramount problem of the training of our young men. But I am equally convinced that the future of the engineering industry depends very largely upon the establishment of healthy human relationships amongst all who are engaged in it. I am sure that with goodwill and good temper those happy relations can be established and maintained. Nothing has enheartened me so much as to witness the excellent sportsmanlike spirit which has resulted from the activities of welfare and recreation. Such activities now cover a very wide field and experience convinces me that wherever such activities are the most flourishing there also will be found the healthiest type of industrial community—healthy both in physique and in ideals.

Industrial Welfare Society.—In this connection I should like to refer to the valuable work done by the Industrial Welfare Society. H.R.H. the Duke of York, as President of that Society, has actively interested himself in every movement which aims at the humanisation of industry and there is no doubt that the welfare movement must be counted as one of the most potent factors for good in the industrial situation to-day.

Organisation of Welfare Schemes.—By the organisation of welfare schemes an employer is able in some measure to return to the old days when workshops were small and when a personal and friendly relationship existed between master and man. By the cultivation of a healthy and contented *personnel* he is also ensuring a maximum of co-operative effort with its inevitable consequences, namely, a high degree of productive efficiency and a fuller measure of prosperity for all.

Whilst the employer must naturally take full responsibility for what may be termed workshop welfare, by which I mean safety provisions, lighting, heating, canteen, &c., it is my opinion that so far as external or recreational welfare is concerned, such is best left to the initiative and management of the staff and workpeople themselves. The secret of success in such organisations is to efface as far as possible the idea that the firm is running the recreation club. Let the firm provide the field, the club house and perhaps a proportionate money grant, but beyond this the organisation should be self-supporting and self-governed. The spirit of friendly rivalry and the beneficial effect of team work, engendered on the playing fields, never fail to have an immediate reflection on the interest shown in the workshop as well as in the development of a sane and healthy citizenship.

Influence of the Mechanical Engineer on Mankind.—In conclusion, it is of interest to consider the influence which the mechanical engineer has had generally upon mankind and the progress of civilisation. Such an abstraction must of necessity descend to platitudes, for it would appear that there are hardly any fields into which his services have not been pressed with advantage to the community. This century has seen man's primitive industry, the tilling of the soil, revolutionised by the introduction of machinery in order that the resources of the vast areas now required to feed the people shall be exploited to their fullest extent, with the result that mechanised agriculture yields food at a far cheaper rate to an immense population than did individual effort less than a century ago for a small number of inhabitants. The production of foodstuffs developed to so high a degree of perfection leads one to think of the means of their distribution, and it is here that the hand of the engineer is most manifest, that is to say, in shipping, railways, and road transport. Since the war we have also seen the development of aerial transport for the purposes of commerce. Not only does the mechanical engineer take a share in feeding, clothing, and transporting members of the community, but he takes a principal part also in protecting their health by sanitation and by water supply. In short, it is true to say that the well-being, the health, the happiness, and the prosperity of mankind are due in no small measure to the inventiveness, resources, and skill of the mechanical engineer.

We inherit a tradition of service to the community which it is the destiny of the younger generation of engineers to maintain and advance. Surely so great a heritage of progress and achievement should encourage us to go forward with renewed faith and energy.

ANNUAL DINNER.

On Thursday, October 18th, the Institution held its annual dinner at the May Fair Hotel, London. A company of nearly 390 members and guests assembled under the chairmanship of the President, Mr. Richard W. Allen. Responding to the toast of "His Majesty's Ministers," proposed by Lieut.-Colonel E. Kitson Clark, the Rt. Hon. W. C. Bridgeman, M.P., First Lord of the Admiralty, expressed the hope that the Admiralty might one day be able again to utilise the coal of this country as a source of the fuel required by the Navy. The toast of "Science and Industry," proposed by Mr. Daniel Adamson, was responded to by Sir Ernest Rutherford, O.M., President of the Royal Society. Sir Ernest said that never before in the history of physical science had progress been more rapid than at present in the study of the constitution of matter and radiation. The quantum theory, after a useful life of about ten years, was dead, and in its place we had a still more terrifying wave theory. The laws of Newton would, he remarked, always hold good for engineering operations, but Einstein had shown that if we could speed up masses to the velocity of light, the whole of Newtonian mechanics would go wrong. Sir Alan G. Anderson, responding to the same toast, said that movement was the essence of trade. The present state of depression was to be ascribed to the efforts made since the war by each nation to stop the trade movements of others. The final toast was "The Institution of Mechanical Engineers," and was proposed by Lord Ampthill. Replying to it, the President commended the Institution's Benevolent Fund to the attention of the members. If each member would contribute 10s. per year the fund could be established on a basis adequate to meet all difficult cases.

Institution of Engineers and Shipbuilders in Scotland.

The address which was given on Tuesday, October 9th, on the occasion of Mr. R. D. Moore's entry on his second term of office as president of the Institution of Engineers and Shipbuilders in Scotland, dealt mainly with the successful efforts which have been made by marine engineers in the direction of improving the efficiency of the steam engine and steam turbine in order to make those prime movers compete more effectively with the internal combustion engine. The work of Sir Charles Parsons was referred to, and the papers given by Sir John Biles, Lord Weir and Mr. Harold Yarrow were cited as demonstrating the advantages obtainable from high-pressure turbines and water-tube boilers, particularly when such boilers were combined with low-pressure Scotch boilers. The progress of marine stokers was then reviewed, and the results obtained on the cargo steamer s.s. "Mercer," which is owned by the United States Shipping Board, and fitted with pulverised fuel equipment, were discussed at some length. After dealing briefly with the Clarke-Chapman pulverised fuel plant recently installed on the Blue Star liner "Stuartstar," and describing the experiments which in the last few months have been carried out at Messrs. Yarrow's Scotstoun works, with a water-tube boiler, provided with powdered coal-burning equipment, Mr. Moore concluded his address with the following words:—

"In dealing with pulverised coal, the first point to be considered by the marine engineer is that of safety, and in the forefront comes spontaneous combustion, which is a real danger. The liability to self-ignition is present in practically all coals when left to oxidise, and this is increased when the material is in a fine state of division, due to the increased rate of oxidation. It is this factor of rate of absorption of oxygen which determines the liability of coal to spontaneous combustion.

"Dr. Haldane, a leading authority on this subject, in his evidence before the Departmental Committee on Spontaneous Combustion of Coal in Mines in 1921, made the statement that when coal as taken from the mine is powdered, and left in the air under conditions which do not allow it to fire, it gradually becomes less and less liable to heat. It takes up less and less oxygen per hour; it gets less and less dangerous, until finally it is quite inert, and will not take up any more oxygen. If the coal is very finely powdered, this condition occurs in a very short time—within a few days—and the coal is then incapable of spontaneous firing. In this way the coal dust in the roads of mines is no longer liable to spontaneous firing. In practice, however, it is considered undesirable to store powdered bituminous coal for more than a few days, under confined conditions. Apart from this feature, even without much increase in temperature, stored small coal soon changes and loses much of its calorific value. There is also the risk of coal dust, liberated from the store, being stirred up by air currents, forming an explosive mixture and becoming ignited. It is probably with this in view that in all marine equipments so far installed or projected the coal is pulverised on board, and in this way most of the ordinary risks with pulverised coal are eliminated. But the advantages of charging pulverised coal direct into bunkers are so great that every effort should be made to bring about powder bunkering.

"Pulverised coal can be put into bunkers from a store quite as expeditiously as oil. For example, 1 ton of pulverised coal per minute can be forced through 4in. piping by a pressure of 40 lb. per square inch, and in this way can be pumped well over a mile. It has been shown that when air has been largely removed from the store, and inert gas, such as funnel gas—advised under the Brand process—admitted, the pulverised coal is protected from liability to spontaneous combustion, which does not take place in an atmosphere of carbon dioxide, CO_2.

"In this way pulverised fuel of suitable quality might be economically prepared in quantity and stored at the quayside. It could then be delivered as required into ships' bunkers, likewise protected by inert gas. All storage spaces and pipe connections would require to be made tight to prevent the escape of fine dust.

"The advantages of such an arrangement are obvious, namely, saving of time, provision of better material, elimination of troublesome plant, and absence of noise. No saving of space, however, would result, as the powdered material occupies nearly 25 per cent. more bunker space than solid coal, while in the "Mercer" the space taken up by the pulverising plant—about 5000 cubic feet—was about 25 per cent. of that occupied by the bunkered coal. In this case, too, the pulverisers were in duplicate, and probably a further saving in space will be effected in other plants.

"The semi-coke from the low-temperature carbonisation of coal offers a material which is entirely safe from all risks of spontaneous combustion and is specially suitable for short-flame burners. At the present time our Government is spending large sums in developing this process, and high hopes are entertained of great economic possibilities from its use. Pulverised fuel depôts would offer an outlet for the small semi-coke—amounting to 7 per cent.—of low-temperature carbonisation plants. At present this is practically a waste product, but its profitable utilisation would also assist the low-carbonisation plants which are mostly working at a loss, largely due to the difficulty in marketing the products. The low-temperature carbonisation plant at Dalmarnock power station, Glasgow, showed a loss last year because only one-third of the plant was in operation. On the basis of the plant in full operation, even at the present low prices of products, a substantial profit would accrue.

"Welsh steam coal, with from 12 to 14 per cent. of volatile matter, is classed as immune from spontaneous combustion under ordinary bunkering conditions, and I think it would be found that the powder from this coal, which has an ignition temperature in heated air of 470 deg. Cent., would react similarly to semi-coke. Since, however, British coal is preponderatingly bituminous, this quality must chiefly be considered in dealing with the question of the employment of pulverised coal in ships.

"What is the outlet for pulverised coal in marine service, now that it has been proved an easily operated process and an economic success? In the North Atlantic trade routes, between North and South America, in South and West African lines, and generally in trade routes where, on the round trip, bunkering does not greatly affect the cargo-carrying capacity, pulverised coal burning ships would have a distinct advantage over oil-fired ships or motor ships. On long voyages, such as to Australia and the Far East, the internal combustion engined ship certainly has the advantage, as oil can be carried in the double bottom without encroaching on the cargo space, and the complete voyage can thus be made without refuelling. Countries which require to import both coal and oil, such as Scandinavia, will probably continue to use oil. At the present time, 99 per cent. of American ships along the Pacific coast are oil burning, and a coal-burning or Diesel-engined American ship is seen very rarely, so the chance of pulverised coal being adopted on that coast is very small.

"At present, however, what most concerns Britain is that every possible encouragement should be given to the development of pulverised coal, in order to assist our stricken coal industry.

"The employment of pulverised coal is a very interesting problem, upon which attention is being increasingly focussed. It may be possible to have at each port a central station where the coal could be crushed into powder, and then distributed to ships as is presently done with oil. The coal might even be crushed at the collieries, and by means of pipes of sufficient size be blown to these central stations, thus saving the exorbitant railway dues. The whole question opens up a fascinating subject, well worthy of study."

SIXTY YEARS AGO.

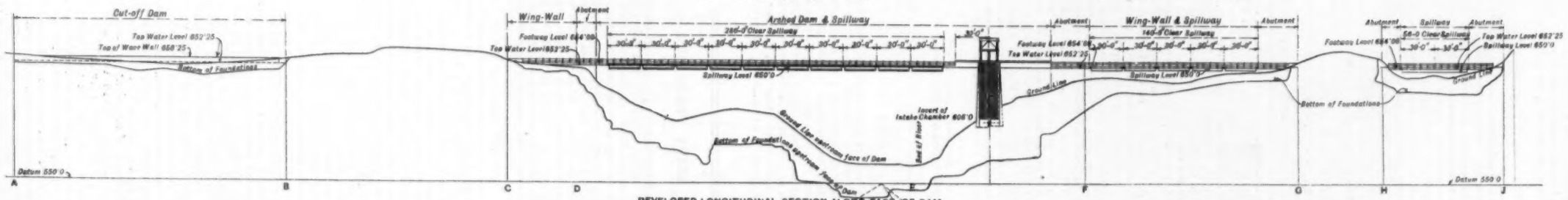
By 1868 the Bessemer process of steel making was well established in many countries, but the discriminating manufacturers in the North of England could already see that it would shortly have a very serious rival in the Siemens-Martin process and were taking steps accordingly. Others, however, foresaw the eclipse of the Bessemer process in different directions. There was, for instance, the Heaton process, concerning which we gave the first public account in our issue of October 23rd, 1868. This process, when we wrote about it, had been in operation on a manufacturing scale and with complete success for some considerable time previously at the Langley Mill Works, near Nottingham. Like the Bessemer process, the Heaton process made use of pig iron and converted it by internal reactions into steel or "steel iron," as its inventor called it. The converter consisted of a tall cylinder of boiler plate lined with fire-brick and surmounted by an open cone and funnel. The cylinder was open at the foot and was supported at some distance above the floor level. Beneath its open lower end short cylindrical lined pots resembling crane ladles could be placed one at a time. In use the pot was charged with a known weight of crude nitrate of soda on top of which was placed a fairly thick plate of cast iron perforated with many holes. Through a hopper in the side of the converter a ton or so of molten pig iron was run into the pot. For a space of about two minutes, during which time the perforated plate was becoming heated, nothing happened. Thereafter there was an escape of brown nitrous fumes in moderate quantity, followed by a copious emission of blackish, then grey, and then whitish fumes. After five or six minutes deflagration occurred, attended with a roaring noise and a burst of brilliant yellow flame from the top of the chimney. This stage lasted about a minute and a-half, and after it there was tranquillity. After tipping and cooling the metal produced was found to have a crystallo-fibrous structure and to resemble "malleable iron of the very purest and finest quality," and almost entirely free from sulphur and phosphorus. One passage through the rolls was sufficient for its after treatment. We published reports on the process compiled by Dr. Miller, Vice-President of the Royal Society and Professor of Chemistry at King's College, and by Mr. Robert Mallet. Both these gentlemen spoke in praise of the process and the product. Dr. Miller stated that the chemical principle was good and that tests by Mr. Kirkaldy showed that the material could be produced with uniformity from batch to batch. Mr. Mallet held that the Heaton process had an almost measureless field in front of it, particularly as a means of permitting the manufacture of high-class wrought iron and excellent steel in the Cleveland and other districts where the raw materials were of an inferior kind.

H

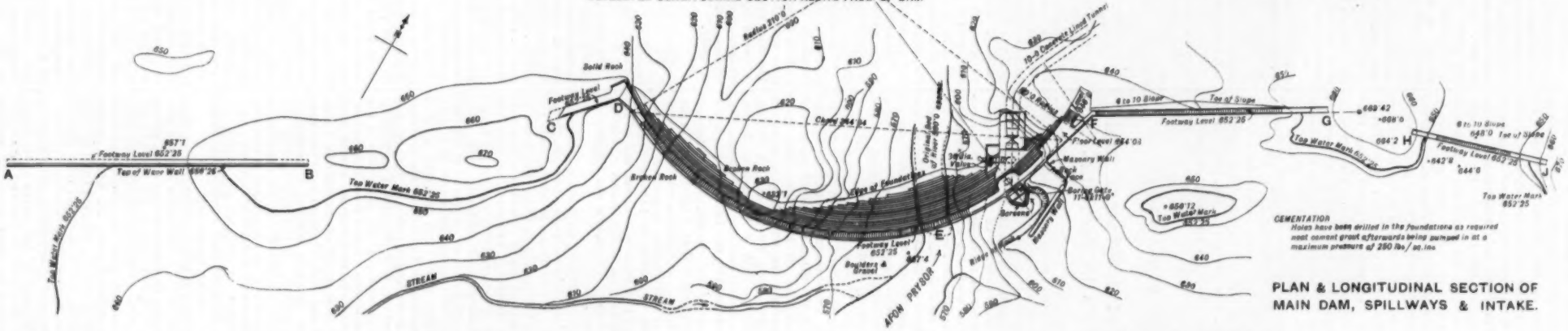
MAENTWROG HYDRO-ELECTRIC POWER PLANT—MAIN DAM AND CONDUIT TUNNEL NO. 1

MESSRS. SIR DOUGLAS FOX AND PARTNERS, WESTMINSTER, ENGINEERS

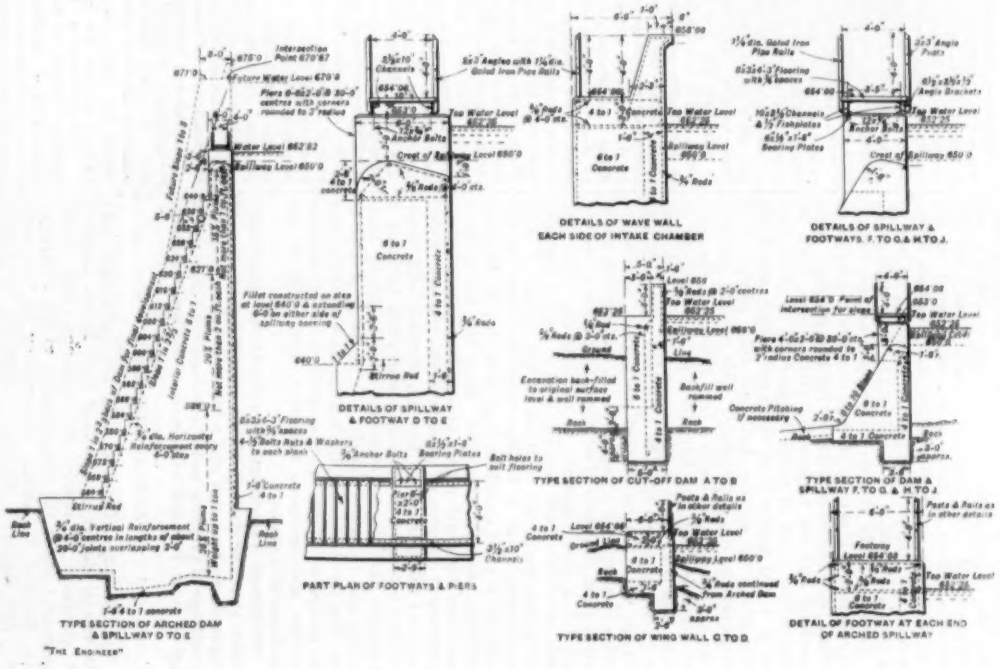
(For description see opposite page)

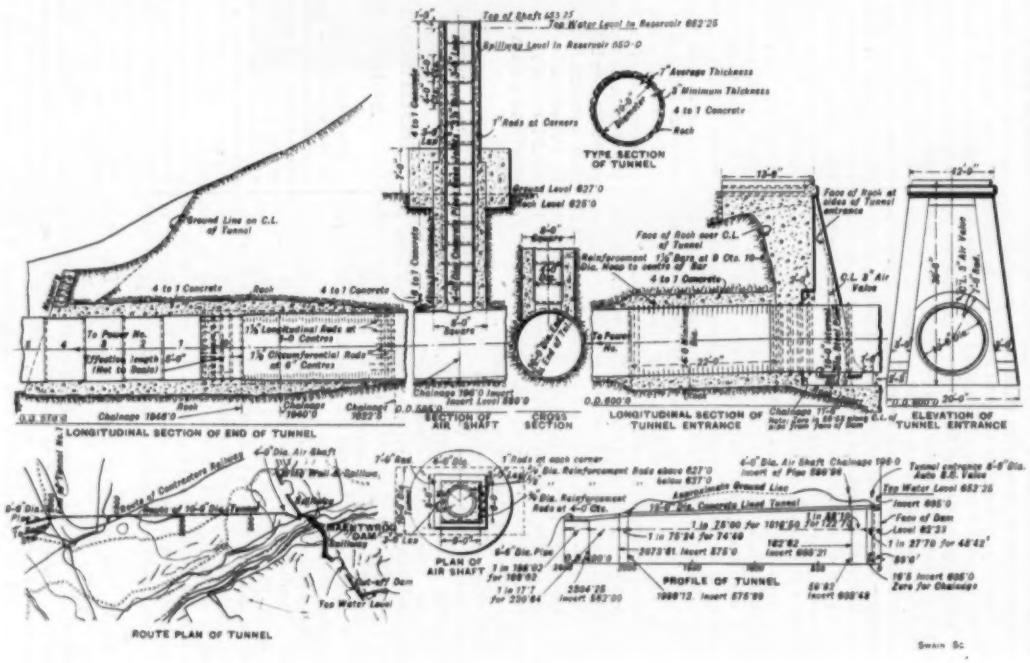


DEVELOPED LONGITUDINAL SECTION ALONG FACE OF DAM



PLAN & LONGITUDINAL SECTION OF MAIN DAM, SPILLWAYS & INTAKE.


TYPE SECTION OF ARCHED DAM & SPILLWAY D TO E
DETAILS OF SPILLWAY & FOOTWAY D TO E
PART PLAN OF FOOTWAYS & PIERS
DETAILS OF WAVE WALL EACH SIDE OF INTAKE CHAMBER
DETAILS OF SPILLWAY & FOOTWAYS, F. TO G. & H TO J.
TYPE SECTION OF CUT-OFF DAM A TO B
TYPE SECTION OF WING WALL G TO D
TYPE SECTION OF DAM & SPILLWAY F. TO G. & H TO J
DETAIL OF FOOTWAY AT EACH END OF ARCHED SPILLWAY


TYPE SECTION OF TUNNEL
LONGITUDINAL SECTION OF END OF TUNNEL
SECTION OF AIR SHAFT
CROSS SECTION
LONGITUDINAL SECTION OF TUNNEL ENTRANCE
ELEVATION OF TUNNEL ENTRANCE
PLAN OF AIR SHAFT
PROFILE OF TUNNEL
ROUTE PLAN OF TUNNEL

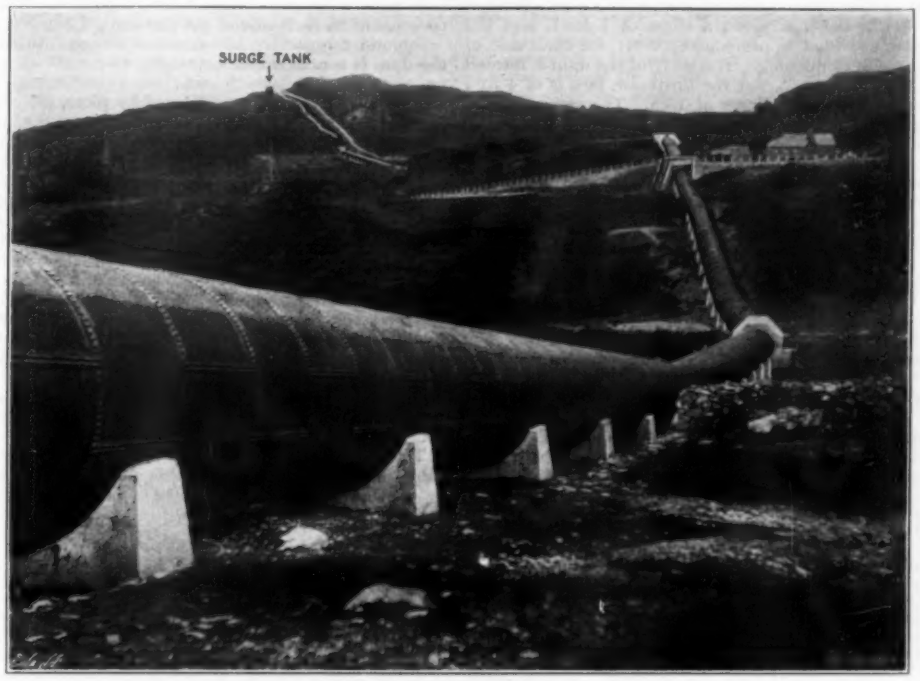
The Maentwrog Generating Station and Electricity Supply in North Wales.

No. II.*

In our first article we described the equipment at the Maentwrog generating station of the North Wales Power Company, Ltd., and discussed the lake or reservoir from which it is supplied with water. Our readers will remember that, for the formation of the latter, it was necessary to build four dams. The construction of three of those dams—the Gyfynys, Hendre'r-Mur, and the Trawsfyndd—was described, and the fourth, the main, or Maentwrog, dam, was briefly referred to. We shall now proceed to give further particulars concerning it. Our remarks will be the more readily understood by the aid of the topmost drawing on page 454, and that at the left-hand lower corner on the same page, the first of which shows a developed section along the face of the dam and a plan, while the other gives sections and details of various parts of the dam.

The dam, as we pointed out, is really made up of three separate structures—(*a*) a cut-off dam, A to B in the drawing, on the west side; (*b*) an arched dam and straight spillway, C to G in the drawing; and (*c*) a further spillway, H to J in the drawing, on the east side. The cut-off dam does not call for much comment. Its construction was necessary on account of a depression in the ground, and it was formed by a parallel-sided wall of low height, founded in rock, with a footway and wave wall at its summit, as in the case of the three other cut-off dams.

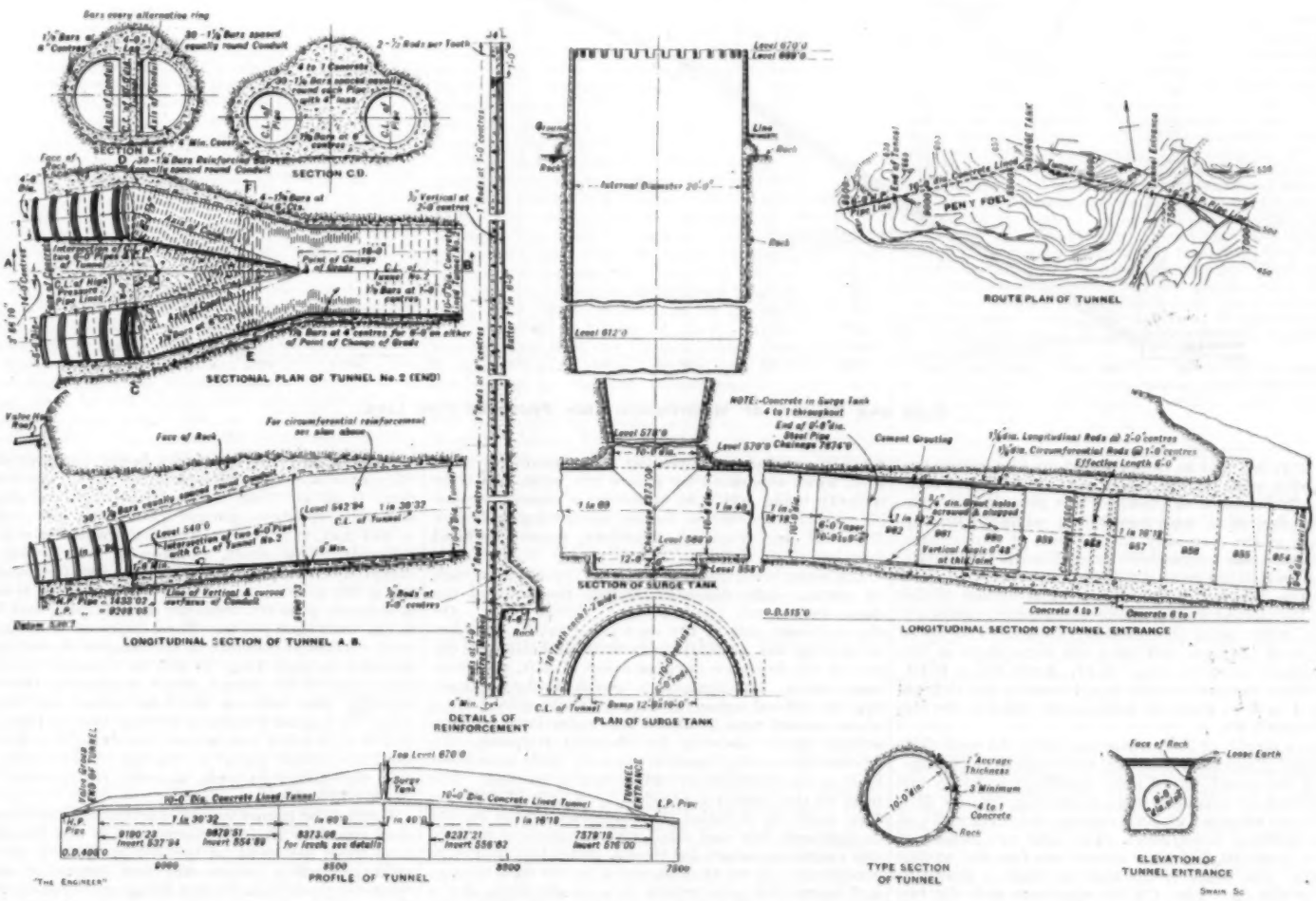
The dam proper is, as was stated in the first article, an entirely different structure from the cut-off dams. It consists first of all of a short wing wall taken into the rock face of the gorge on the west side. The rock at this point was of a solid character, so that there were no difficulties with the foundations. A type section of this wing wall—C to D on the drawing—is given among the details in the left-hand bottom corner on page 454. It is formed with a core of 6 to 1 concrete, but on the water side and in the footstep of the foundation 4 to 1 concrete is used, the thickness of the water side facing being 1ft. 6in. The whole of the upper part of the wall above top water level is also composed of 4 to 1 concrete. In the water side facing ¾in. reinforcing rods are arranged at 4ft. centres, and at a depth of 3in. from the face. The more, ¾in. rods arranged horizontally were put in at 4ft. centres in the water side facing layer. These rods, which were bound to the vertical reinforcing rods, were continued so as to overlap corresponding horizontal reinforcing rods, which, as will be explained later, are employed in the arched portion of the dam.



A Portion of the Low Pressure Pipe Line

The arch portion of the dam is built throughout to a radius of 210ft., the length of the chord subtended by the arch being 344·04ft. A type section of the dam is given in the left-hand engraving at the foot of page 454. The elevation of the original bed of the river was approximately + 560ft. O.D. The spillway level is + 650ft. O.D., so that the maximum height of the spillway crest above the stream bed is approximately 90ft. To secure a satisfactory foundation, it was necessary to excavate to varying depths throughout the length of the arch, but the maximum height of the dam above the lowest point in the foundations did not exceed 115ft. The nature of the rock encountered varied considerably. In some parts the rock was solid, but in others it was much broken. Hence the depth of excavation required was by no means the same throughout the whole length of the dam. This point is well brought out in the drawing of the dam, which gives the line of the bottom of the foundation on the upstream face.

It will be realised that for an arch dam in which heavy stresses are imposed upon the rock at the ends lower ends are taken well into the key footstep, which goes down to approximately 3ft. into the solid rock, and is 2ft. 6in. wide. Reinforcing rods, ¾in. in diameter, were also employed in the manner shown in the drawing in the portion above top water level. Further-



Tunnel No. 2, Route Plan, Profile, and Sections

* No. I. appeared October 19th.

of the dam, it was essential to take great care in exposing sound rock for the abutments, and, indeed, much more excavation was necessary to obtain these sound abutments than was actually done in providing the foundation in the deeper portions of the dam.

The dam has a vertical face on the upstream side,

while the downstream side has a slope of 1 in 2¾ to within 10ft. of the spillway crest level. To facilitate the formation of a satisfactory junction between old and new work, should it be decided at some future time to increase the height of the dam, the downstream side is stepped, the steps being 4ft. high and 18in. wide. All the steps, save the uppermost, are flat on the top, but the top step, which is at a level of + 640ft. O.D., is given a slope of 1 in 1, and the triangular fillet is prolonged for 6ft. on each side of the spillway opening. The body of the dam is formed of 6 to 1 concrete, but the upstream face is of 4 to 1 concrete for a thickness of 18in. The stronger concrete was also employed for the lowest part of the foundations. The minimum thickness of the layer of 4 to 1 concrete in the foundation was 18in., but in parts the depth was considerably greater, since that strength of concrete was employed for filling up the core trench. The greatest width of the dam at the base is 34ft. 6in., but the foundations are constructed of a width sufficient to carry any future raising of the dam.

For the most part, the structure is of plain mass concrete, but in the 18in. thick upstream face of 4 to 1 concrete, and on the stepped down stream side, there are ¾in. horizontal and vertical reinforcing rods, arranged in both cases at 4ft. centres, saving that, above the + 640ft. O.D. level, the horizontal rods are at 2ft. centres. The vertical reinforcement is in lengths of about 20ft., and the joints were allowed to overlap 2ft. For the lowest 45ft. or so, including the foundation, "plums" of weights not exceeding 1 ton each were allowed in the concrete up to a maximum of 25 per cent. of the whole volume. In the next 35ft., 20 per cent. of plums of not greater size than 2 cubic feet each, were permitted; while for the top portion of the dam only 15 per cent. of plums, each not larger than 1 cubic foot, were allowed. The width of the dam at the crest is 6·0ft.

In the drawing of the typical cross-section of the dam, the dotted lines indicate the addition necessary if the water level is eventually raised. The lower portion of the dam will have the same slope as has the present structure, *i.e.*, 1 in 2¾. From the + 624ft. O.D. level upwards to the top, however, the slope is to be 1 in 5, so that the width of the dam at the top will become 8ft.

For a length of 300ft., starting from the west side, the crest of the dam is formed with spillway openings. There are, in all, ten of these openings, and they are separated by concrete piers measuring 6ft. by 2ft., which are arranged at 30ft. centres, the total width of clear spillway being 280ft. The piers are formed of 4 to 1 concrete, and their corners are rounded to 2in. radius. The shape of the spillway crest is shown in one of the drawings. On the upstream side the top edge is rounded to a radius of 6in., while the top edge on the downstream side is rounded to a radius of 2ft. The whole of the body of the spillway crest for a depth of 2ft. 6in. from the top is of 4 to 1 concrete, which is integral with the 4 to 1 concrete in the upstream face of the dam. Reinforcing rods, ¾in. in diameter, which are lapped round the ¾in. rods in the two faces of the dam, are arranged in the manner shown in the drawings.

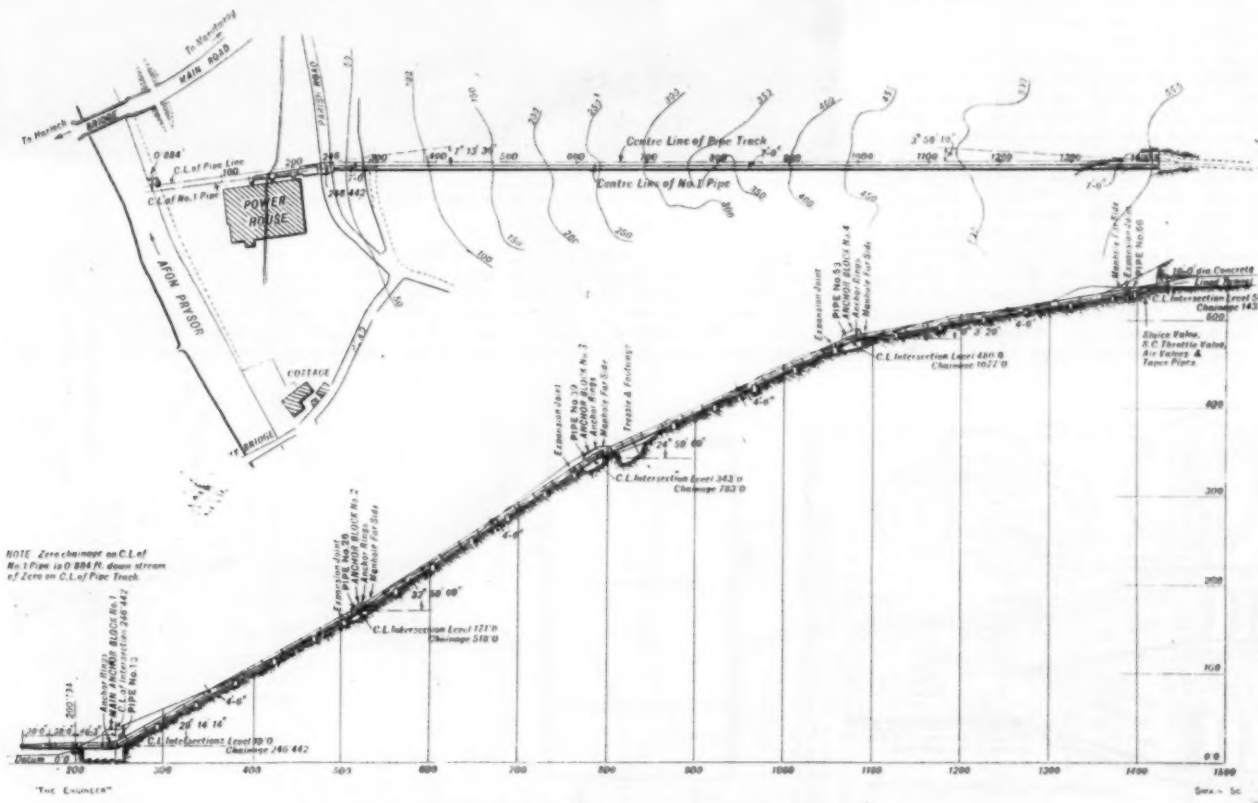
On the tops of these piers steel channels, 10in. by 3½in., are laid on edge some 4ft. apart, and are secured in position by means of 12in. by ¾in. anchor bolts. These channels are for carrying a footway, the top of which is 4·08ft. above spillway-crest level. Handrails formed by vertical posts of galvanised angles, 3in. by 3in. by ¾in. and 1¼in. diameter galvanised iron pipe rails are arranged for protection of foot-passengers on each side of the footway.

Beyond the eastern abutment of the arch portion, the dam is continued as a straight wing wall—F to G on the drawing—which acts as a spillway. The spillway has five openings, formed by piers, 2ft. wide, which are arranged at 30ft. centres, as are the piers in the arched portion, and are of similar construction to them. The crest of the spillways, however, are different in shape from those on the arch portion. The upstream top edges are rounded to a radius of 4in., and the downstream edges to a radius of 18in. One of the drawings on page 454 shows the type section of this portion of the dam, and it will be observed that the downstream face is given a slope of 6 to 10, and is curved at the bottom to a radius of 2ft., the toe being, where necessary, protected by concrete pitching. Except in the particulars mentioned this portion of the dam does not differ in construction from the cut-off dams already described, and does not call for particular comment. It, however, is surmounted with a footway and handrails of a similar construction to those over the arch portion.

The detached portion—H to J in the drawing—of the dam to the eastward of this spillway is a much smaller structure, containing two openings, each 30ft. wide, separated by a pier 2ft. wide, the clear spillway being 56ft. It, however, is exactly similar in general construction to the main wing wall just described, and does not, therefore, require detailed description.

The water is led from the reservoir first of all through an opening 10ft. diameter through the body of the dam, the invert level being + 605ft. O.D. On the upstream side of the dam is an intake chamber formed by two vertical concrete walls built into the face of the dam at a distance apart of 13ft. 6in. from face to face. This chamber is furnished with duplicate sets of vertical screens from just above invert level of the outlet pipe to above top water level. These screens are removable, for cleaning purposes. To protect the screen chamber masonry walls have been built in the reservoir, as will be seen in the plan. The inlet to the pipe is controlled by a gate of 11ft. by 11ft. built up of rolled steel sections, plated on the downstream face and filled with concrete to provide the weight necessary for closing under free discharge conditions. A winch is mounted on the dam to raise and lower the gate, which is normally kept above top water level. To lower the gate the brake handle on the winch is lifted and the speed of lowering is automatically governed.

At the downstream end of the outlet opening there is a length of steel piping tapering from 10ft. diameter to 8ft. 6in. diameter, and coupled to an 8ft. 6in. automatic self-closing throttle valve, as a protection against a burst in the pipe line. We shall describe the action of this valve and its construction later. It is connected at its other side to a further 10ft. diameter steel pipe, which is taken to the portal of a 10ft. diameter tunnel, just over 62ft. from the downstream face of the dam. The invert level at this point is + 605ft. O.D., that is to say, at the same level as the invert in the intake chamber in the dam. For 22ft. or so from the face of the rock, the tunnel opening was excavated to a diameter of at least 14ft. The 10ft. pipe, the end of which was furnished with four anchor rings made of ⊥ sections set at 18in. centre to centre, was, when fixed in the correct position, grouted into the excavations with 4 to 1 concrete. Its end was arranged to project in about 5ft. beyond the face of the tunnel portal. Beyond it the conduit was continued by lining the excavation with concrete. Up to the end of the 14ft. diameter excavation the lining was reinforced with rings formed of 1¼in. bars bent into hoops 10ft. 4in. diameter, the hoops being arranged at 9in. centres. Beyond that point the diameter of the excavation was considerably reduced, and the lining was of plain concrete without reinforcement. An elevation of the tunnel portal and a longitudinal section of the tunnel entrance are given in the right-hand lower drawing on page 454. The same drawing also gives a profile and a route plan of the tunnel. For the first 43·42ft. the tunnel is on a falling gradient of 1 in 27·7. For 122·7ft. beyond that point the gradient is 1 in 38·10 downwards, and for the remainder of the tunnel, a length of 1816·5ft., there is a continuous falling gradient of 1 in 75·0. The total length of the tunnel is just over 1960ft.



PLAN AND PROFILE OF MAENTWROG HIGH-PRESSURE PIPE LINE

set at 6in. centres and 1¼in. straight rods arranged longitudinally at 1ft. centres. Adjacent to the end of the 9ft. 6in. piping the concrete was tapered from 10ft. diameter to 9ft. 6in. diameter. The adjoining length of 9ft. 6in. pipe, which was furnished with three anchor rings of angle section, comes within the reinforced portion of the lining. Four further lengths of 9ft. 6in. pipe had to be added before the portal was reached. The whole arrangement is shown in the drawing already mentioned. The invert level of the tunnel at the outlet portal is + 575·99ft. O.D.

Beyond the tunnel portal the conduit consists of a length of 5700 lineal feet of 9ft. 6in. diameter riveted steel pipe, the plate thickness varying from ⅜in. to ½in. The route and profile of this line of low-pressure pipes was given in the drawing on page 430 in our last issue. It runs, as will be observed, in a by no means straight line, and is all above ground, following the contour of the surface. Generally speaking, however, it is on a falling gradient, and at no point does its invert rise higher than + 584·20ft. O.D. A view of a portion of it is given on page 455. The photograph from which the engraving was prepared was taken looking from Tunnel No. 1, which has just been described, towards Tunnel No. 2, the portal of which comes below the highest ground seen on the skyline in the distance. Appearing over the summit of the hill to the left of the highest point is the top of the surge tank, to which reference is to be made below.

The pipe line is furnished with anchor blocks of concrete where there are changes in horizontal direction, and is carried between those blocks by shaped concrete piers. It is also provided with expansion joints, manholes, scour valves and air valves, where it was desirable to put them.

At its downstream end the pipe line enters tunnel No. 2, where it has an up gradient of 1 in 13·2. The junction between the pipe and the entrance to the tunnel was effected very much in the same way as in the Tunnel No. 1, and as it is shown in the drawing on page 455 there will be no necessity to describe it in detail. The tunnel itself is neither entirely straight nor level. From the portal to near the surge tank it is straight. Then comes a short curved portion, over the centre of which the surge tank was constructed, and from the further end of which the tunnel runs straight to the outlet portal.

A profile of tunnel No. 2 is given at the left-hand side at the bottom of the drawing. It will be seen that the invert level at the inlet portal is + 516·0ft. O.D. For a length of 658·03ft., the tunnel is on an up gradient of 1 in 16·18, and at the end of that incline the invert is at + 556·62ft. O.D. Then for a length of 135·85ft. the gradient is reduced to 1 in 40, and the invert level at the termination of that gradient has become + 560·0ft. O.D. It is above this point that the surge tank was formed. Beyond it for a length of 306·45ft. the tunnel is on a down gradient of 1 in 60 till an invert level of + 554·89ft. O.D. is reached. From there to the outlet portal—a length of 510·72ft. —the gradient is still further reduced to 1 in 30·32, and at the outlet portal the invert level is + 537·94ft. O.D., or 21·94ft. higher than the invert level at the inlet portal.

The tunnel has a total length of 1611·05ft., and it is of 10ft. diameter throughout until quite near the outlet portal, where a special construction was necessary, as we shall explain in due course. The lining is of 4 to 1 concrete, the minimum thickness being 3in., while the average thickness is 7in.

Drawings of the surge tank are given on page 455. The tank was formed by sinking a circular shaft from the surface of the hill through which the tunnel is driven down to the tunnel itself, the depth of the excavation being some 95ft. to the tunnel invert. The shaft is lined throughout with reinforced concrete, the diameter inside the lining being 20ft. The concrete is 4 to 1 throughout, and the minimum thickness of the lining is 4in. The reinforcement consists of ½in. rods arranged vertically at 2·0ft. centres, and ½in. rods arranged horizontally at 1·0ft. centres. The lining was carried up to some 15ft. above rock surface level, so as to form a circular tank, the top of which is toothed or castellated, the teeth being 14in. wide and 1ft. high. The reinforcement of the above rock portion is shown in the drawings, and need not be particularised here. At rock surface level a shoulder was formed round the shaft by increasing the thickness of the lining. This shoulder and its reinforcement are also shown on the same drawing. The top of the tank is at an elevation of + 670·0ft. O.D., or 20ft. above the reservoir spillway level. The 20ft. diameter of the tank is continued down to + 612·0ft. O.D. Then for a further depth of 34ft. it is tapered until at + 578·0ft. O.D. the diameter is reduced to 10ft. The remaining 8ft. between the roof of the tunnel, which stands at + 570·0ft. O.D., is 10ft. in diameter throughout.

Up to the end of the tunnel the works have been constructed with a capacity sufficient to convey the whole volume of water required for the ultimate development. Initially, one high-pressure pipe line 6ft. in diameter has been installed, and provision made for a second pipe to be installed in the future. The tunnel outlet is bifurcated as shown on page 455.

Beyond a point some 48ft. from the end of the tunnel, the diameter of the excavation was increased, as was also the thickness of the concrete lining, and reinforcement was employed. Thirty 1¼in. bars were arranged equally spaced longitudinally round the circumference, and hoops of 1¼in. bars were inserted at 1ft. centres for a length of 10ft. Beyond that point the spacing was reduced to 4in.; 6ft. further on the down gradient was increased to 1 in 5·96. Just beyond the point of change of gradient, the excavation was considerably widened out, and the construction of twin conduits of the form shown in the section on the line E F in the left top corner of the drawing, was begun, the angle of the fork being 40 deg. Gradually the "D" form of these two conduits was developed to circular shape, until, as will be seen in the section on the line C D, two outlets, 6ft. in diameter, were formed. The arrangement of the reinforcement will be seen in the drawing. It is at this point that intersection between the tunnel and the high-pressure pipe line proper takes place. As will be seen in the drawings, the built-in pipes, which are each furnished with six anchor rings of ⊥ section, are tapered. One tapers from 6ft. to 5ft. 6in., and it is that which is in service conveying water to the power-house. The other is fitted with a sluice valve and blanked off.

A valve-house has been constructed at the tunnel portal. It contains the sluice valves, a self-closing throttle valve, and air valves, to which further reference will be made later. Immediately downstream of the throttle valve the pipe is enlarged to 73½in. external diameter, and an expansion joint is fitted.

The total length of the high-pressure pipe line from the No. 2 tunnel outlet to the power station is 1400ft. From the valve house the pipe descends in a straight line sharply downhill to the power-house—see page 456. There are four changes in the angle of slope. In the topmost length the angle between the centre line of the pipe and the horizontal is 9 deg. 31 min. 20 sec. In the second the angle is 24 deg. 59 min. 06 sec.; in the third, 32 deg. 59 min. 09 sec.; and in the lowest, 29 deg. 14 min. 14 sec. At each change of slope there is an anchor block of mass concrete stepped into the rock, and in each case the pipe is fitted with thrust rings. In anchor blocks Nos. 2, 3 and 4 there are two such rings, but in anchor block No. 1—the lowest at power-house level—which is necessarily more substantial than the others, there are three rings. Immediately below each of the anchor blocks Nos. 2, 3 and 4, there is an expansion joint, and above each there is a manhole. Between the anchor blocks the pipe is supported on shaped concrete piers, fitted with steel bearing plates. The surface of the rock in the line of the pipe track is levelled, for which purpose a certain amount of excavation had to be effected, and the distance between the centre line of the pipe and the levelled surface is kept even at 4ft. 6in. At the foot, the pipe terminates in a tapered manifold, from which the branch pipes to the turbines are taken off at 30ft. centres. The intersection level between pipe line and manifold comes at + 19·0ft. O.D. The pipe line is 73½in. outside diameter throughout, and the thickness varies from 1in. at the power station to ½in. in the upper lengths. The longitudinal joints in the pipes are lap-welded, and the circumferential joints are of the parallel bump type, single or double riveted.

At this point it will be convenient to give the names of the various contractors concerned in this undertaking. The main contractors for the hydraulic works were Sir Robert McAlpine and Sons, and they had as sub-contractors:—(*a*) For the low-pressure pipe line, the Cleveland Bridge and Engineering Company, Ltd.; (*b*) for the valves for the hydraulic conduit, Glenfield and Kennedy, Ltd.; (*c*) for the high-pressure pipe line, the South Durham Steel and Iron Company, Ltd.; and (*d*) for the gate at the inlet to the conduit at the dam, Boving and Co., Ltd. The contractors for the power-house equipment were:—For the turbines, Boving and Co., Ltd., with the English Electric Company, Ltd., as sub-contractor for the generators; for the switchgear, Reyrolle and Co., Ltd.; for the transformers, Ferranti, Ltd., and the English Electric Company, Ltd.; for the crane, S. H. Heywood and Co., Ltd.; for the cables, Pirelli General Cable Works, Ltd.; and for the lighting, the West Wales Electric Company, Ltd.

The Charfield Railway Disaster.

At the opening inquiry on Thursday afternoon, October 18th, into the serious accident at Charfield on the previous Saturday, Sir John Pringle heard the evidence of some of the postal officials on the train, and of three passengers, and then of some local residents who were early on the scene of the accident, as to the outbreak of fire.

On Friday evidence was given by Mr. H. E. Morgan, signal assistant to the Western Division engineer, as to the heights of the signals and to the fact that they were electrically repeated in the signal-box. After the accident the signalling was tested and found to be in order. The signalman at Berkeley-road Junction testified that at 4.30 a.m. it was hazy, but he could see 300 yards away, and so there was no need to call out the fogmen as the limit laid down was one of 150 yards. After 5.30 conditions were worse, but still not sufficiently bad to need the fogmen. Berkeley-road South Junction—the next box to the South—was switched-out at that time as it was only open from 5.45 a.m. The Great Western freight train was "cleared" from Charfield, 5¼ miles away, at 5.14, and he then offered the mail which was accepted, and it passed his box at 5.16. On producing his train-register it was seen that at 5 a.m. he had recorded the weather as "Foggy." He thought that "Misty" would have been a more correct phrase.

The signalman at Charfield said that his instructions were that fogmen were necessary if he could not see the back-light of his down inner home signal, 150 yards away. That signal was quite visible at the time, although the atmosphere was then a little hazy. The Great Western freight train arrived at 5.13, and he told the driver and guard to shunt into the down siding. He accepted the mail but did not, and could not because of the interlocking, lower his distant, outer home and inner home signals. The track-circuit indicator in his box showed that the train was still on the points, and he was watching the indicator when the collision occurred.

The driver of the up freight train said that though it was foggy he could see his signals approaching Charfield, but going through that station the atmosphere seemed to be getting thicker. Answering the inspecting officer, witness said that he thought it was a case in which fogmen ought to have been on duty. His fireman said he could see the up distant 100 yards away, but the home signal was more difficult and the fog was thicker. On going to the wreckage he saw a long jet of lighted gas issuing from one of the cylinders. The guard of the up train said that the fog was thick in places but not bad enough to need fogmen. It got thicker after the collision.

After evidence had been given as to the correct working of the signal repeaters and other electrical apparatus, the district carriage and wagon foreman said that he inspected the wrecked coaches at 10 a.m. whilst they were still red-hot, and found that three out of the four gas cylinders were intact and undamaged. The fourth had been opened about 8in., apparently by the excessive heat. Answering Sir John Pringle, witness said that there were no safety valves on the cylinders.

The driver of the mail testified that he saw all the signals at Berkeley-road. There was a patchy fog but it was not dense. He would, though, have expected fogmen out at some places but not at Berkeley-road. He crossed over from his own—the right—side of the footplate in order to get a view of Charfield distant. The thickness of the fog got worse. He saw a green light in the distance and knew that it was the "distant," which intimated that all the signals at Charfield were right for him. He then crossed back to his own side of the footplate and did not see the outer or inner home signals. The fireman of the mail said that when they had passed Berkeley-road the driver asked him to look out for the Charfield signals. He was not well acquainted with the road, and his difficulty was increased by the thickness of the fog. He saw a green light and said, "Right away, mate!" and then started firing. The guard considered the atmosphere a little foggy and there was visibility for only about 100 yards.

Mr. C. R. Byrom, chief general superintendent, said that the number of electrically-lighted coaches at the present time was not sufficient to cover the whole of the company's trains. The train concerned was primarily a mail train, on which, as a general rule, very few passengers travelled. It was low down on the list for electrically-lighted stock.

Mr. E. J. H. Lemon, carriage and wagon superintendent, testified that since 1923 all new stock on the London, Midland and Scottish had been equipped with electrical lighting. Gas-lighted coaches were being broken up at the rate of approximately 1000 a year. In the period 1923–28, 3528 vehicles had been constructed, 99 per cent. of which were electrically lighted. The exceptions were the kitchen cars. During the same period 2728 gas-lighted vehicles had been taken out of service. The company now had 11,874 gas-lighted vehicles, and 11,633 electrically-lighted. Steel-framed coaches were being experimented with, but they were 10 per cent. heavier and were hotter in summer and colder in winter. They cost 50 per cent. more. Answering Sir John Pringle, he said that he would not like to contemplate what would have happened if the coaches at Charfield had been steel-framed. They would have been badly crushed, and the consequences would have been worse. In a collision-proof train, if nothing gave way after crashing into buffers at 60 miles an hour, the passengers would be killed and severely injured by being thrown forward.

Sir John Pringle then said that he found it impossible to continue his inquiry as there were a number of witnesses too ill to attend. The inquiry, therefore, would be postponed *sine die*.

A Visit to the General Electric Company's "Magnet" Works.

To meet the great demand that is expected to arise for domestic appliances, industrial heating apparatus, and electric light fittings and accessories, as the result of the Government's electricity scheme, the General Electric Company has acquired an extensive and conveniently situated group of factories in Landor-street, Birmingham. In these new works over 1000 electric radiators are already being completed each week, whilst the weekly output of electric irons is considerably more than three times this quantity. Other things, such as electric grills, toasters, kettles, &c., are also being turned out on a very large scale.

The works are situated close to the centre of Birmingham with a wide frontage to the main London–Birmingham line. The transport facilities could scarcely be surpassed, for the works adjoin both main lines of the L.M.S., which pass through Birmingham, and, as a private siding runs into the works, direct communication is available with London, Manchester, Liverpool, Bristol, Sheffield, Leeds, and York, as well as many other important industrial centres, which are on the railway company's main lines. The Birmingham and Warwickshire Junction Canal also adjoins the works.

The main factory consists of a three-storey building arranged in four communicating blocks, and, in all, there are eleven spacious bays, each 300ft. long and 50ft. wide. On the side of the building remote from the railway one block is of two-storey construction. Grouped round the main factory are several other extensive workshops, as well as a large administrative building. The lay-out and equipment of the works are naturally in accordance with the

most modern principles. Each stage in the production, from the reception of raw materials to the dispatch of the finished article, is arranged so that there is a regular and ordered flow of material continually available in each department, and in every part of the factory very careful attention has been paid to handling and transport.

The principal sections of the works, which are devoted to the preliminary operations necessary before parts are ready for assembly, comprise the casting, grinding, press, capstan, general machine, and sheet metal working shops. The press, capstan and general machine shops are mainly concerned with the production of the components required for domestic electrical appliances and electric light accessories. In the press shop, for example, the body of an electric kettle is pressed from a circular sheet of copper. The two parts of the spout are similarly produced, and subsequently soldered together. Naturally, the shops contain many aisles of machinery for repetition operations. The machine tools in the industrial heating and cooking machine shop are of an entirely different character to those mentioned, for they comprise punching and shearing machines, flattening rolls, &c., suitable for dealing with the heavy plates associated with the construction of large baking ovens, furnaces, &c. All the finished parts for domestic appliances, the lighter forms of cooking and heating equipment, and electric lighting accessories are placed in the stores, which occupy the ground floor bay of one of the building blocks, and they are requisitioned for assembly as required. Two of the main 300ft. bays are devoted to the assembly of domestic appliances, and a third bay is reserved for the same purpose. In one of these bays the resistance elements are wound. In order to allow for expansion and contraction of the element with changes of temperature, the resistance ribbon is passed between two small pinions, which are loosely meshed so as to impart a corrugated outline to the ribbon, which is then wound tightly round the mica strip. Resistance elements for electric fires, pedestal heaters, and similar appliances, are made with circular section resistance wire, which is wound on a mandrel of the correct diameter. The mandrel is driven by a small electric motor, and a device fitted to the mandrel indicates the exact length of wire for the particular apparatus into which the element is to be incorporated. After the completion of the process of assembly, each piece of apparatus is sent to the testing department. Electric welding and cutting play an important part in the manufacture of industrial cooking and heating appliances, and ovens and furnaces are built in accordance with sound engineering principles.

In the manufacture of electric fittings many fascinating processes are involved. In the case of large ornamental fittings, many castings may be necessary, whilst for the smaller units one casting will often suffice. After careful examination, the rough castings are taken from the foundry to the stores, and then to the making up and chasing shop, where skilled workmen impart a finish to the castings. In some cases spinning and turning are necessary, and the operations are also carried out in the fittings shop. The parts are next taken to the dipping, polishing and plating or metal colouring shops, where they are given an appropriate finish in oxidised silver, copper, silver plate, antique brass, &c., the last process to which they are subjected being lacquering.

Much might be written on the electric light accessories department, the testing department, &c., and on the lighting of the works, but it must suffice to mention one or two of the company's most notable products that were brought to our notice during our recent visit to these works. Great strides have recently been made by the company in the manufacture of large electric baking ovens. It claims, we gather, to have built the largest ovens of this type in the country. Ovens have been constructed that will bake no fewer than 1000 loaves at once. Cooking equipments are also being continually made for use in hotels, restaurants, on board ship, in public institutions, works canteens, and large business premises. The equipments include electric rotary ovens, double oven ranges, cabinet roasting ovens, pastry ovens, steaming ovens, grillers, fish fryers, boilers, hot oven ranges, cabinet roasting ovens; in fact, every possible type of utensil needed in modern cookery. Among the things which the company has devised for the utilisation of electric heat are water boilers, resistance furnaces, sterilisers, immersion heaters, warming plates, laundry and tailors' irons, glue pots, sealing wax heaters, skirting and window heaters, and convector heaters.

An electric annealing furnace which has been in operation at the works for some considerable time is employed for annealing sheet brass and copper stampings. The furnace is supplied with three-phase 440-volt, 25-cycle current, and the loading is 80 kilowatts. Resistance heaters are fitted under the hearth plate and in the side walls. Near the furnace is the automatic temperature control gear, by means of which the temperature can be automatically maintained at the desired value, the maximum temperature being 1000 deg. Cent. Some 2-kilowatt immersion heaters were also brought to our notice. Three of these heaters were fitted to a water tank for the purpose of showing the adaptability of these heaters to the conversion of ordinary tanks to electric heating. A 4ft. by 4ft. double-deck baking oven of the Pell type, fitted with Humidor steam injection apparatus, was also on view, the loading being 10 kilowatts per deck. We were also shown the company's system of heating rooms by means of skirting heaters, in conjunction with thermostatic control, a japanning oven, a muffle furnace, and an electric kettle, which is switched off automatically in the event of all the water being evaporated.

British Engineering Standards Association.

Some interesting facts in relation to the present position of British engineering standardisation and international standardisation were expounded at the tenth annual general meeting of this Association, which was held at the Institution of Mechanical Engineers on Tuesday, October 16th, under the chairmanship of Mr. Maurice Wilson.

Over 100 new and revised specifications have been issued by the Association, and over 90,000 British Standard Specifications have been sold. There are over 500 committees and 2700 engineers and business men throughout the country giving their time and energy to this work. There were actually 568 meetings last year.

The Association has lodged a petition with the Privy Council for a Royal Charter, and in this has received the full support of the leading technical institutions.

The reorganisation, which has been under consideration during the past year, is gradually maturing. It will mean considerable simplification and decentralisation so far as the new Council is concerned.

Imperial Conference on Standardisation.

Reference was made to the Committee on Simplification and Standardisation of the Board of Trade, and the hope was expressed that the Government would at no distant date call an Imperial Conference on Standardisation, as the necessity was felt for immediate action with a view of harmonising the work of the British Engineering Standards Association and that of similar organisations in the Dominions, particularly Australia.

Coal.

Probably the most important piece of work undertaken recently is that of the preparation of Standard methods for the Commercial Analysis and Sampling of Coal. In this work the Association has the most cordial support and assistance of the Fuel Research Board of the Department of Scientific and Industrial Research, as well as of all branches of the coal industry. Whilst the question of approved Methods of Analysis may not be so difficult to arrive at, there is no doubt that to set up standards for the sampling of coal presents immense difficulties, and it is probable that agreement will have to be arrived at along more or less conventional lines. After all, the industry in different parts of the country has been sampling coal, particularly for export purposes for years, and if only general agreement can be arrived at on some conventional basis to which all can subscribe, the Committee will be doing much to assist the coal industry.

The chairman made interesting reference to the assistance which the B.E.A.M.A. has given the work of standardisation through its Trade Standardising bodies, whereby it has been able to give the B.E.S.A. Committee the consensus of views of the electrical industry as a whole and assist the B.E.S.A. to come to decisions of value to all concerned.

Shipping.

Reference was made to the difficult work of standardising the details of ships and their machinery, particularly in regard to interchangeability. The chairman regretted the impossibility of making much progress along these lines, unless the shipbuilding industry of the country could adopt some such method as the B.E.A.M.A. had adopted, in order that the various trade problems involved might be discussed and solved by the industry itself.

Electrical Standards.

As on previous occasions both the Electrical Industry and the Automobile Industry appeared to be making great strides in standardisation. The former had been standardising under the ægis of the B.E.A.M.A. for the past twenty years, and it is acknowledged on all hands that the British Standard Specifications for electrical machinery and apparatus have been of the utmost value in our electrical trade.

An interesting specification mentioned was the Street Lighting Specification, which Mr. G. F. Colquhoun, public lighting engineer of Sheffield, had said should be put into operation in every city and town in the country. The demonstration which was made under his ægis in Sheffield a few months ago, was visited by many people, and should prove a fine piece of propaganda work for the British Standard Specifications.

International Standardisation.

Attention was drawn in the report to the fact that the question of international standardisation, outside of electro-technics, had been considered during the past two years. The main Committee, desiring to go only as far as British industry, as a whole, felt to be wise, authorised the calling of a number of Conferences, so that before taking a final decision in the matter it might be fully informed as to the views of industry on those international proposals. The result of these Conferences showed definitely that British industry was not favourable to any general movement towards international standardisation in mechanical subjects, at any rate on the lines suggested by continental friends, though it appeared to be decidedly in favour of Imperial standardisation. At a special meeting held on March 21st, 1928, the main Committee, after very fully reviewing all the facts before it, came to the definite decision to disassociate the B.E.S.A. from any further endeavour towards the formation of an International Federation of the National Standardising Bodies. In coming to this conclusion, it felt that whilst International Standardisation might lead to reduction in costs of production in many cases, questions of tariffs and differing systems of measurement, together with the lack of complete American co-operation, precluded any hope of carrying the scheme forward successfully. Nevertheless, the direct and friendly relations already existing between the National Standardising bodies will be maintained. This will enable any specific subject, upon which agreement may be thought helpful to international trade, to be discussed by a Committee representing those countries desiring to take part, the initiating country acting as secretariat. Should British industry be fully in favour of co-operating in such discussion, the B.E.S.A. would then do its best to promote agreement.

During the course of the meeting, the chairman said that many directors of industries had not fully grasped the fact that here was an organisation, independent of Government control, entirely impartial, actually in their midst, and that its services were at their disposal. One important way in which the B.E.S.A. could assist the home market was in the preparation and issue of British Standard Specifications for materials, which, because of the absence of any agreed standard, were often dumped in this country from the Continent, often of inferior quality. No firm realising that could surely afford to lose touch with the work of the B.E.S.A., and indeed one would have thought that the mere instinct of self preservation would have led more and more firms to support that national movement.

Mr. Llewelyn Atkinson also drew attention to the fact that the Association was faced with a demand from bodies to have their products standardised, but it was beyond the power of the Association in its present financial position to meet those wishes. He urged all those engaged in the industry to support the Association. He was afraid the Association had not yet succeeded in getting into the minds of the industry as a whole what it was doing in the way of cheapening products by standardising them, and in the way of reducing the number of patterns, machines, plants, dies, &c. The Association was really adding very largely to the profits of the industry by the work it was doing.

Obituary.

MR. L. P. PERKINS.

We hear with regret of the death of Mr. Ludlow Patton Perkins, which took place at Lansdowne House, Regent-street, Lancaster, on October 18th, at the age of fifty-six years. Mr. Perkins was the younger son of the late Loftus Perkins, and a great grandson of Jacob Perkins, the famous inventor.

He went to Lancaster in the year 1902 from Manchester, in which city he was, for a number of years, associated with Hy. Wallwork and Co., Ltd., and also with Joseph Adamson and Son, of Hyde, with whom he was interested in the high-pressure stopped-end tube boiler; in fact, his speciality was steam at very high pressures, on which subject there was no better authority. He was a director of the Lune Valley Engineering Company, Ltd., of Lancaster, and latterly practised as a consulting engineer, devoting his energies to the development of refrigerating apparatus.

OSMAN SHAW.

The death, at the early age of forty-nine, is announced of Mr. Osman Shaw, chairman of the firm of Francis Shaw and Co., Ltd., Manchester. Mr. Shaw served his apprenticeship at his father's works, which were founded in 1879. The business was incorporated into a limited liability company in 1909, and Mr. Osman Shaw had been chairman of the company since its formation. He was a founder member of the Engineers' Club, Manchester, of which institution he was a most generous supporter.

THE INSTITUTE OF MARINE ENGINEERS.

The Council of the Institute of Marine Engineers draws attention to the various awards which are offered periodically for competition. The following are offered annually:—

(*a*) The Denny Gold Metal, for the best paper read by a member during the session. (*b*) The Institute Silver Medal, for the best paper read by a non-member during the session; and (*c*) the John I. Jacobs Memorial Award, value £5, for the best essay by a student graduate or graduate giving an historic account of the progressive advance in steam pressures in recent years, together with the modifications of design adopted in the modern steam boilers to meet these new conditions.

The following are offered every two years, and are available this session:—

W. Murdoch and D. F. Robertson Combined Award, value £13, for the best essay by an associate, student graduate, or graduate on one of the following subjects:—(*a*) The evolution of the valves and mechanism controlling the flow of the working fluid in (1) steam or (2) internal combustion engines; (*b*) the erection of machinery in place, giving details of the more usual troubles experienced due to faulty assembly; (*c*) the steering system of a modern ship; (*d*) shop methods suitable for the economical production of a marine steam turbine, or shop methods of testing a large marine steam turbine. The Herbert Akroyd Stuart Award, value approximately £56, open to members of all grades and non-members for the best paper on "The Origin and Development of Heavy Oil Engines," read at the Institute before April 30th, 1930.

The following are offered every three years, and are available this session:—The Sir Archibald Denny Award, value £15, for the best essay by a sea-going member on "Hints and Deductions from Practical Experience which may be Useful in Improving Ship and Engine Design." The Stephen Award, value £15, open to all grades of membership for the best essay on one of the following subjects:—(*a*) The conditions that must be observed in the design and lay-out of the steam pipes on board a ship in order to secure safety, economy, and convenience in use at all times; (*b*) the auxiliary machinery fitted in an up-to-date vessel; (*c*) the evaporating plant as fitted, detailing the special points that must be attended to in its design and maintenance to secure the highest efficiency; (*d*) electric machinery and fittings necessary in the present-day passenger ship; (*e*) the advantages and disadvantages of the internal combustion engine for marine purposes; and (*f*) the value of workshop experience, *i.e.*, technical skill in the use of tools, &c., to the engineer at sea.

Further information regarding the competitions may be obtained on application to the hon. secretary, Mr. James Adamson, the Institute of Marine Engineers, 85–88, The Minories, London, E. 1.

H.M. Inspector of Mines for the Cardiff and Newport division has issued his report for the year 1927. There were 80 mines using coal-cutting machines, which totalled 352. Fifty-three of the machines were electrical and 299 were worked by compressed air. The number of collieries was reduced by one, electrical machines increased by eight, and compressed air machines reduced by five, compared with 1925. The quantity of coal cut by electricity increased from 238,204 tons to 433,264 tons, and by compressed air from 2,104,579 tons to 2,330,138 tons. The number of conveyors at the coal face increased from 635 at 78 mines to 698 at 87 mines, eight being electrical and 690 driven by compressed air.

Railway Matters.

THE escalators on the Underground run over half a million miles per annum.

A DEVICE that has been successfully tried on some French railways is a machine for weeding the permanent way, which is at present done by gangs of men and is a costly operation. It is claimed that with two men the new machine will hoe the weeds at such a speed that the cost becomes very small.

THE London, Midland and Scottish line from Shrewsbury, by which the trains from South Wales reach the main line to the North, enters the large marshalling yard from the south-west at Gresty-lane signal-box. In order to deal more readily with the traffic from that direction a new group of sidings has just been brought into use which will accommodate 1200 wagons.

THE report for 1926–27 of the Indian Railway Board, says that mainly owing to the introduction of telephone traffic control the maximum number of goods trains over the Allahabad-Cawnpore section of the East Indian Railway—a single line—has been increased from eight or nine in each direction daily to thirteen trains. Owing to the better use of the vacuum brake, the average speed of Indian goods trains from start to finish, including stops *en route*, has been increased from 9·08 miles per hour in 1923–24 to 10·1 miles per hour in 1926–27.

A PROPOSAL made by a private syndicate has been received by the Governments of Argentina and Uruguay for the construction of a railway and pier at Colonia-del-Sacramento (Uruguay), on a peninsula on the Rio Plata facing Buenos Aires, from which port it is 15 miles distant and from Montevideo 153 miles. The estimated cost is 12,500,000 gold pesos (£2,500,000). The terms proposed are a forty-year concession and a joint government guarantee on capital expended of 5 per cent. per annum, plus 1 per cent. for cumulative amortisation.

THE Ministry of Transport inquiry into the fatal collision outside Queen-street Station, Glasgow, on October 12th, was held by Colonel Trench on the following Thursday. That part of the evidence which threw light on the cause of the accident was, however, given in private. It would appear, however, that the empty carriage train entered the tunnel under "clear" signals, and evidently the passenger train to Edinburgh either set back or ran back down the severely rising gradient and collided with the shunting train. A third death has since arisen out of this accident.

IT is with regret that we learn of a collision which took place between a Euston–Aberdeen passenger express train and a goods train between Dinwoodie and Wamphray, just north of Lockerbie, early on the morning of yesterday, October 25th. The passenger train, which was drawn by two locomotives, ran into the rear of the goods train. Both the engines of the express were thrown into an adjoining field clear of the line, while the following six vehicles were derailed. The two drivers and the two firemen lost their lives, but no passengers are reported as being seriously injured.

SOME particulars were given in this column on October 12th of the coal consumption per mile on British railways. As similar figures as to oil consumption may also be of interest, the Railway Returns for 1927 show that 6·80 pints of lubricating oil are used per 100 engine miles. In passenger service the figures are:—Southern, 6·97; Great Western, 6·40; London, Midland and Scottish, 6·63; London and North-Eastern, 7·26. In freight service the corresponding figures are:—8·20, 7·21, 6·77, and 7·67 respectively, and in shunting service they are 6·14, 5·05, 6·29, and 4·60.

IN this column of our issue of July, 15th, 1927, we referred to the new Epsom Town Station at the junction of the Raynes Park branch of the former London and South-Western Railway with the main line of the old Brighton Railway. There were four lines of way through that station and only two platforms. The latter were on the outer lines and the junctions were such that they could only be reached by the Raynes Park trains. The new station will have island platforms for the common use of all trains, and the first stage has just been effected by leading the Raynes Park down line into the Brighton down line and carrying the face of the down platform up to that line and closing the former outer line.

ACCORDING to the annual report for 1927 of Colonel Sir John Pringle there were during the year 7494 failures of couplings in goods trains and of 1967 in passenger trains. Of the former, 1017, or 13·6 per cent., were cases of uncoupling only; 4604, or 61·4 per cent., were the pulling out or breakage of drawbars or hooks; 1725, or 23·0 per cent., were the breakage of coupling links; and 148, or 2·0 per cent., the breakage of screw shackles. Of the 1967 failures of passenger train couplings 92, or 4·7 per cent., were uncoupling; 959, or 48·8 per cent., were the pulling out or breakage of draw bars or hooks; 571, or 29 per cent., the breakage of coupling links; and 345, or 17·5 per cent., the breakage of screw shackles. The chief liability to failure, observes Sir John, is thus to be found in the weakness of draw gear.

WE have to record the death on October 18th of Mr. W. J. Thorrowgood, who retired a year ago from the position of signal and telegraph superintendent of the Southern Railway. He joined the London and South-Western Railway in December, 1877, and until 1907 was in the telegraph department. On the signal and telegraph departments being combined in the latter year, he became assistant to the signal and telegraph engineer, and eventually, in December, 1918, was appointed head of the department, and when the Southern Railway was formed, took the signals and telegraphs for the whole system. He retired from that position in September, 1927. To him mainly the railway service was indebted for the remarkably successful light signalling system installed by the Southern Railway in the London area. Mr. Thorrowgood was a member of several learned societies; the President of the Institution of Railway Signal Engineers for 1924–25; a member of the Ministry of Transport Departmental Committee on Light Signals; a reporter to the International Railway Congress of 1925, and a lecturer on signalling in several railway and municipal schools.

Notes and Memoranda.

A NEW metal that will cut a screw thread in a glass rod, bore a smooth hole in a block of concrete, and cut the hardest of steels, was described by Mr. Samuel L. Hoyt, of the research laboratory of the General Electric Company, at the annual Convention of the American Society for Steel Treating. The new material, which is named Carboloy, is said to be composed of tungsten carbide and cobalt, the carbide being extremely hard and the cobalt giving it the necessary strength for cutting tools.

THE income of the Port of Calcutta for the year 1927–28 amounted to Rs. 3,38,82,124 and the expenditure on revenue account to Rs. 3,02,46,409, giving a surplus on the year's working of Rs. 36,35,715. The year was a record one both in regard to the total tonnage of ships entering the port and the total quantity of goods handled at the jetties and docks; 1418 vessels entered having an aggregate net tonnage of 4,638,569 tons. The total quantity of goods handled at the jetties and docks amounted to 6,143,098 tons.

THE number of furnaces in blast in this country at the end of September was 131, a net increase of one since the beginning of the month. The production of pig iron in September amounted to 503,900 tons, compared with 519,000 tons in August and 591,500 tons in September, 1927. The production included 156,700 tons of hematite, 201,500 tons of basic, 108,700 tons of foundry, and 19,600 tons of forge pig iron. The production of steel ingots and castings in September amounted to 718,600 tons, compared with 648,300 tons in August and 777,000 tons in September, 1927.

OUR contemporary, the *Electrical World*, describes a new type of lightning arrester, consisting of a high-speed compensated impulse gap in series with a liquid current-limiting resistance. The latter consists of two small tanks, mounted one above the other, containing a calcium chloride solution, and connected by two or more thin composition tubes, also containing the electrolyte. If a normal frequency current follows an impulse discharge across the gap, it is immediately interrupted by the vaporisation of a portion of the electrolyte in the tubes. Oscillograph records show that one or two cycles is sufficient to quench the arc at the gap. Owing to its small cost, the arrester may be placed at frequent intervals along the line, which is the best way of dissipating the surge energy. An arc-over does no harm to the arrester, and the gap may be set for only about 10 per cent. above line voltage.

THE increasing interest in the use of electrical or other geophysical methods for the location of underground ore deposits has led the United States Bureau of Mines to study the possibilities of the use of the megger circuit for the measurement of the variation of ground resistivity, an important factor in this means of mineral prospecting. The megger may be used to measure the various average resistivities at different depths from the surface or to compare the various average resistivities at the same depths. With its use it is possible to locate the direction of the dip and strike of a concealed intrusion, such as a body of ore. About three sites or areas can be measured in one day to a depth of 600ft., by a crew of three men. The megger as it is built at present is not entirely suited for geophysical prospecting, states Dr. F. W. Lee, in Technical Paper 440, just issued by the Bureau of Mines. Various improvements which would help in the operation of this instrument in the locating of underground ore bodies are summarised in Technical Paper 440.

A PAPER was recently read by Mr. L. Romero before the Municipal Engineers' Association on the distribution of electricity in cities and towns. He pointed out that the maintenance of the consumer's pressure to within 4 per cent. of the declared pressure was becoming increasingly onerous. A good case could be made for extending the limit to 6 per cent. over the declared pressure. In practice the variation generally exceeded the 8 per cent. of the total variation permissible by the regulations. He was strongly of opinion that poly-core, paper insulated, lead-covered and armoured cables were the best to use for distribution whether direct current or alternating current was employed. In industrial districts he advised installing sub-stations on the premises of large consumers. These might be so close together that special sub-station buildings belonging to the undertaking would be unnecessary. The most promising means for improving the load factor was to encourage the storage of electrically heated water by consumers. The author favoured the distribution of electricity by the low-tension, three-phase, four-wire system. His experience led him to think that the cheapest way of changing over a large power consumer was to wait until he went out of business and then start his successor with an alternating-current supply.

ON the occurrence of back fire in a rectifier there is a liability of parallel-operating rectifiers to feed into the short circuit and cause overload tripping of the entire direct-current bus-bars. To avoid this, the affected rectifier must be cut out of circuit on both alternating-current and direct-current sides as quickly as possible, and the healthy sets must not be tripped. One available method is "reverse-current selective protection." Polarised relays of the current rather than the voltage type can be used, since reversal of the current is a sure indication of back fire. The disadvantage is that the action depends entirely on the occurrence of a reverse current, so that it is not applicable to a rectifier set acting alone. With "unsymmetrical differential protection," use is made of the fact that the cathode current is normally six times the arithmetic average value of the phase current—with a six-anode set. A back-fire upsets this relation, since the cathode current is either reduced or reversed, while the phase current increases on account of the short circuit. Various disadvantages have prevented the adoption of protective apparatus operating on this principle. "Symmetrical differential protection" is applicable when, as is usual, an absorption choke is used to divide the six anodes into two groups of three. Normally, the current is shared equally by these groups, but a back fire on one anode upsets the equality. A tripping gear is easily devised to operate under these conditions, and the system has been found in practice to be satisfactory.

Miscellanea.

THE new red lead and litharge works of the Chemical and Metallurgical Corporation, at Runcorn, will, it is hoped, be in full operation by the end of this year.

IT is reported from Athens that a convention between the Greek Government and the American firms of Ulen and Monks for irrigation works in the Struma Valley was signed on October 21st and will be submitted to Parliament at an early date.

IN connection with the extensive harbour improvements planned for the port of St. John, New Brunswick, the Harbour Commission Board has awarded a contract for the erection of a grain elevator with a capacity of 1,500,000 bushels. The plant is to be supplied by a Montreal company.

THE price of electricity supplied to the Adwick-le-Street Urban District Council by the Doncaster Collieries Association has been reduced from 1¼d. to 1¼d. per unit, and is to be further reduced to 1d. per unit in November. There is also to be a rebate of 10 per cent. on consumption over one million units a year.

A CONTRACT for a 15,000-ton floating oil factory, to cost £275,000, has been booked by Swan, Hunter and Wigham Richardson, Ltd., of Wallsend. The vessel will be specially equipped for lifting whales on deck and dealing with the oil. The owners are the Viking Whaling Company, a new company with Norwegian and British capital.

ACCORDING to a report from Moscow, the result of the prize competition for a practical process for the manufacture of synthetic rubber has just been announced. The competition, it is said, attracted five entries, of which two were given laboratory tests. A prize of 25,000 roubles has been awarded to the entry sent in under the name "Diolefin."

IN order to help the development of Greek industries, the Ministers for Finance and Economic Affairs have decided to reduce the import duty on machinery intended for instalment in industrial establishments in the country. The reductions are to be announced provisionally by a Ministerial decree, and a Bill sanctioning the reduction is to be introduced in the next session of the Chamber.

THE nineteenth annual Exhibition of Electrical, Optical and other Physical Apparatus is to be held by the Physical Society and the Optical Society on January 8th, 9th and 10th, 1929, at the Imperial College of Science and Technology, South Kensington. As on previous occasions the Exhibition will be divided into a trade section, comprising the exhibits of manufacturing firms, and a research and experimental section.

THE German short-wave high-power station will, it is stated by *World-Radio*, begin broadcasting early next year. Progress is being made with the two simultaneous transmitters at Berlin (East) and Magdeburg, and it is hoped that they will be finished by December. At the Flensburg station work has begun on the aerial masts. With the completion of these three stations the total number of German transmitters, reduced to twenty-four when Dortmund closed down, will be increased to twenty-seven.

THE death is announced of Mr. Edward V. Johnson, formerly inspecting engineer of Canadian Department of Railways and Canals and widely known throughout the Dominion. Mr. Johnson, who was in his eighty-fourth year, died at Ottawa on October 5th. He was born in Fredericton, N.B., and had been with the department for fifty-six years, retiring in 1921. He was a charter member of the Canadian Society of Civil Engineers, now known as the Engineering Institute of Canada, and for two years was a member of the Council.

IN the course of a speech delivered during our recent visit to the new Magnet Works of the General Electric Company, referred to elsewhere in this issue, Mr. M. J. Railing said that the G.E.C. first installed works in Birmingham as far back as 1895, with Mr. Ide and himself in charge. The modest character of the undertaking could be imagined when he explained that the workpeople numbered three and the wage bill was £6 a week. From that small beginning they had grown until 11,000 hands were now employed in the G.E.C. works in the Birmingham district alone. Their new and larger premises at Landor-street, Birmingham, would eventually mean the employment of a large number of additional workers. In 1920 the company adopted the slogan "The All-Electric Home," and had tried to educate the people to the use of electricity for all purposes in the home, and they felt their ambition had largely been realised. In spite of the people who talked of bad times, England was leading in the electrical industry. This old country could produce as good goods as any country in the world.

THE Administration Report issued by the Commissioners for the Port of Chittagong for the year 1927–28, states that the year had been one of exceptional prosperity, during which all previous records established by the Port were broken. The aggregate value of the sea-borne trade of the Port, import and export, foreign and coasting, amounted to Rs. 1833 lakhs, the highest ever recorded. Compared with the previous year, there was an increase of Rs. 414 lakhs, or 29 per cent. Both the foreign as well as the coasting trade had equally contributed to the increase. In the foreign trade heavy increases were noticeable in the imports of railway materials, iron and steel, salt, machinery and millwork, and in the exports of jute and tea. In the coasting trade large imports of paddy and rice are responsible for the increase. The total value of foreign trade rose from Rs. 9,39,70,006 in the preceding year to Rs. 11,51,96,132 in the year under review, recording an increase of Rs. 2,12,26,126, or 22·58 per cent. The foreign import trade advanced from Rs. 1,64,81,542 in the previous year to Rs. 2,81,65,836 in the year under report, showing an increase of Rs. 1,16,84,294. The rise was mainly due to the increased importations of railway materials, iron and steel, salt, machinery and millwork, which recorded an increase of Rs. 12,68,247, Rs. 47,59,848, Rs. 7,16,065 and Rs. 41,08,898 respectively, as compared with the previous year.

NO. 3 LISTER DRIVE POWER STATION, LIVERPOOL

MR. P. J. ROBINSON, M.I.E.E., LIVERPOOL, ENGINEER

(*For description see page 450*)

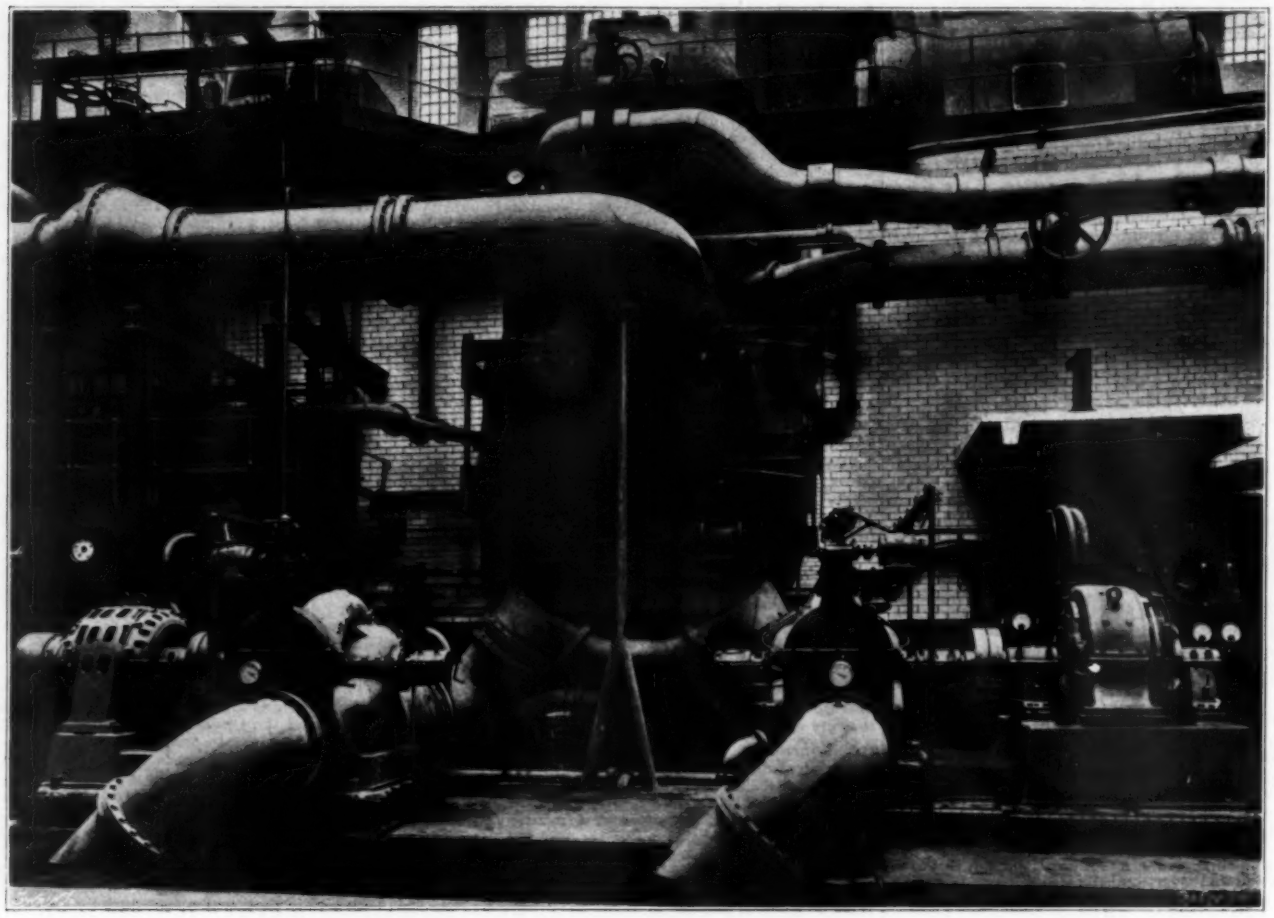


FIG. 24—WEIR CONDENSER AND AUXILIARIES

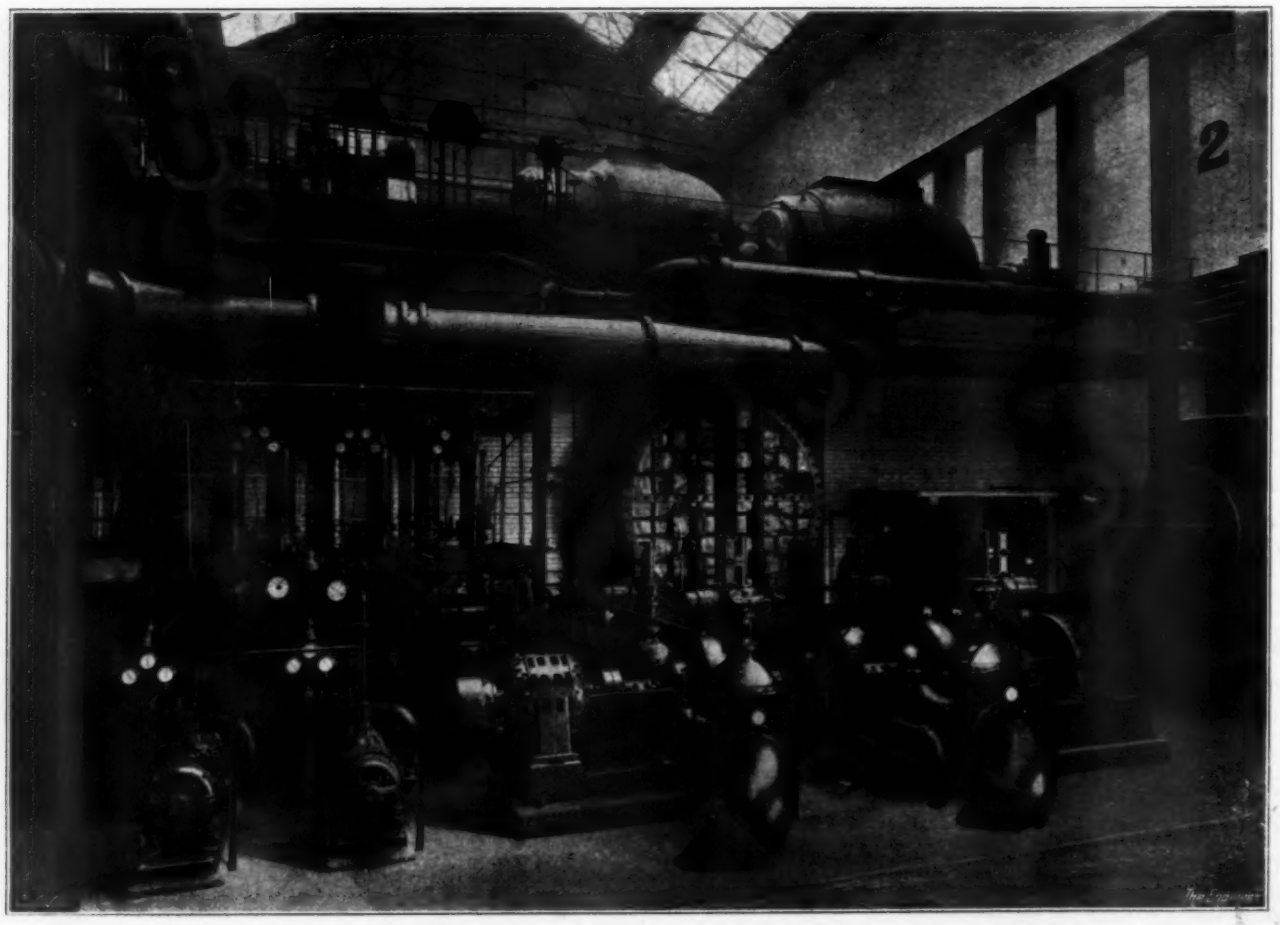


FIG. 25—METROPOLITAN-VICKERS CONDENSER AND AUXILIARIES

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SIXTEEN-PAGE SUPPLEMENT—"THE METALLURGIST."

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The Metallurgist.

THE OCTOBER NUMBER OF THE MONTHLY METALLURGICAL SUPPLEMENT TO "THE ENGINEER" ACCOMPANIES THIS ISSUE.

DEATH.

ON October 18th, 1928, two days before his 86th birthday, the result of an accident, CECIL WEST DARLEY, I.S.O., M. Inst. C.E., of Little Bookham, Surrey, formerly Engineer-in-Chief, Public Works, New South Wales, son of the late Henry Darley, of Wingfield, Co. Wicklow, Ireland.

THE ENGINEER.

OCTOBER 26, 1928.

The Corrosion of Light Alloys.

A PAPER quite recently presented to the Royal Aeronautical Society by Mr. H. Sutton, of the Royal Aircraft Establishment, and the discussion which took place upon it, raises the whole question of the reliability of aluminium alloys, particularly for aircraft construction. Yet in reality the question in the acute form in which some of the speakers in that discussion presented it, does not arise at all. The facts described and discussed by Mr. Sutton, although they might perhaps be regarded as more or less startling by a layman unacquainted with the subject, in reality reveal nothing new—that is, nothing that has not been known for some time by those whose business lies with either the production, the use, or the scientific study of the alloys of aluminium. That, under certain conditions, somewhat rapid and destructive corrosion of even the best alloys of aluminium can occur has long been known and realised. Nevertheless, it has been the deliberate judgment of those best qualified to know that it is sufficiently possible to guard against these destructive conditions to make the use of these materials satisfactory, even for the highly exacting purposes of aircraft. This opinion is borne out by the fact that these materials are in successful use for these very purposes by a number of the most prominent aircraft constructors of other countries, so that the opinion of British experts on this question is fully endorsed by that of the experts of other important nations.

Mr. Sutton's account of a number of ways in which aluminium alloys may be attacked by corrosion and "corrosion fatigue" must be regarded in its proper perspective. The investigator whose business it is to study any particular type of defects and to discover means for their remedy or prevention, inevitably sees a good deal of what may well be termed "the seamy side" of the materials in question, and when he gives an account of his observations the resulting list—regarded apart from the circumstances and purpose of its preparation—may well bear an alarming appearance. The same would apply, however, to the catalogue of a surgeon's pathological collection, and it would be a distorted and morbid view to anticipate similar horrors as incidents of everyday life. On the contrary, the investigator of defects in metals—whether they be due to corrosion or other causes—renders a useful service by calling the attention of his fellow-experts to the worst cases, since in that way he may arrive at better preventive measures himself or stimulate others to find them. It would be most unfortunate to suppress such facts, and equally unfortunate if they were to be misinterpreted in such a manner as to shake confidence in the usefulness and reliability of the metal in question. Actually, as regards the best of the aluminium alloys now in use or coming into use, it seems clear that there is no ground for alarm or even misgivings. The inherent corrodibility of aluminium and its alloys is admitted, but so is that of all but a few special steels. At the same time, the conditions under which dangerous corrosion is likely to occur are being steadily explored and are far better understood than they were a few years ago. Yet even during the years of the war, there were few, if any, cases in which aircraft failed as the result of light alloy corrosion. Such failure can be far better guarded against to-day, thanks to the extensive researches on the subject which have been carried out in this and other countries. We have to-day better protective coatings of the "paint and varnish" variety and better knowledge of how they should be applied. We have—perhaps most important of all—the process of anodic oxidation of aluminium alloys coupled with the application of lanoline or other fatty matter to the thickened oxide coating. Finally, we have the methods of protection by means of electro-deposited metallic coatings which promise to provide a very high or, for practical purposes, a perfect anti-corrosion protection. With such means at our disposal, the only difficulty that need remain is that of securing the entirely adequate application of these protective methods to each particular case. It is vitally important to convince the constructor employing light alloys of the real need for these protective measures, and an account of cases of failure that have arisen in the absence of satisfactory protection is, perhaps, the best means of bringing home the truth.

The two special features of light alloy corrosion which are perhaps of most importance can be summed up under the words "corrosion fatigue" and "inter-crystal corrosion" respectively. With regard to the former, there can be no doubt that the recent researches of McAdam in America have shown clearly how important a part even a slight degree of corrosion may play in hastening the fatigue fracture of most metals, and of light alloys in particular. But surface protection is a definite remedy for this action, and, besides, it is an action that only comes into play where a part is subjected to a great number of alternations of stress. This may be a serious consideration in the moving parts of machinery, but scarcely in the parts of a structure—even of an aircraft structure. Vibration will, perhaps, be suggested as a source of fatigue-stressing, but unless vibration is excessively severe, it scarcely entails stresses lying at or beyond the elastic limit of the material. It is only where vibration of extreme amplitude, arising from some form of synchronism, occurs that serious stress cycles can arise from that cause, and there it is surely for the designer to step in and correct an error that leads to gross effects of this kind. Inter-crystalline corrosion, or perhaps better "corrosion cracking," is by no means confined to aluminium alloys. It is a phenomenon which is closely related to the well-known "season cracking" of brass and to the so-called "caustic embrittlement" of boiler plates. It seems that in many metals, particularly under the combined action of stress and corrosion, chemical attack can become concentrated in the crystal boundaries. Attack of that kind is liable to affect the metal to a great depth without showing much surface destruction, but the trained eye can scarcely fail to detect the surface indications. The most important fact to be borne clearly in mind

however, is that such inter-crystalline corrosion is always due to attack coming from outside and commencing at the surface. If therefore the surface is properly protected and, particularly during construction, is thoroughly inspected, danger from this source can be eliminated. The conditions which tend to favour its occurrence, also, are now coming to be understood. The user of light alloys, therefore, is in a good position to safeguard himself, and it is in the immediate interests of the manufacturer of light alloys to aid him in every possible way in that direction. There is clearly need for care, but no cause for alarm.

On the broadest grounds it is to be sincerely hoped that the frank and full discussion of the problems of corrosion as they affect aluminium alloys will, in future, be encouraged in every way. Such discussion is desirable in the best interests of future progress and of securing the thorough adoption for immediate purposes of the best protective methods known. It would be most deplorable if, through lack of perspective, the facts cited in such a discussion were so misread as to cause misgivings or alarm as to the safety of light alloy structures. Modern aluminium alloys represent some of the most important achievements of metallurgy and have done much to make possible the aeronautical achievements of to-day. It is very doubtful whether they have ever contributed to the sacrifices which the progress of aircraft has entailed. Anything that would, unreasonably, engender prejudices against their use would set back the clock of engineering, and particularly of aircraft progress.

Men and Management.

Whilst every part of Mr. Richard Allen's Presidential address to the Institution of Mechanical Engineers on Friday last was followed by a very large audience with the closest attention, it was that section which dealt with the problems of works management that made the greatest effect. During the reading of this part there was frequent applause, and the members showed in other ways their sympathy with the views expressed by their President. Mr. Allen, indeed, put into a few sentences the modern philosophy of works management, and it may be doubted if there were any dissentients in the audience, for it is now generally agreed that the improvement in the human relationship between employers and employed is one of the chief factors in the maintenance of peace in industry. The great firm of which Mr. Allen is chairman has always, ever since the days of its honoured founder, been amongst the first to recognise the duty which employers owe to their workpeople, and, as it was amongst the earliest to adopt the welfare scheme, so it has been in the forefront of the wisest administration of that scheme. It has provided an "Institution" and recreation grounds, and continues to help with funds and active sympathy, but it has left the actual organisation to the employees themselves, and has avoided that autocratic interference which has done much in the past to wreck welfare schemes and render them odious to the trades unions.

It is well known, too, that "Allen's" provide educational facilities for their young men, and that they regard the training of young engineers as one of the duties of management. Mr. Allen holds, we are rejoiced to know, that it is only in the workshop that the real engineer can be made, and, in consequence, it is to the owners of works that we must look for the supply of engineers to satisfy the requirements of the future, and to uphold the traditional excellence of British engineers. But he recognises that education is not complete if it only makes engineers or craftsmen. It must also make men. He expressed this view in the following admirable sentence, which deserves indeed to be inscribed upon the walls of every engineering works. "What is needed in the engineering industry to-day is a fuller appreciation of the value of education, not merely as an aid to production, but as an aid to fullness of life and happiness. If we are merely training men to become engineers or craftsmen or machine operators we are performing but a transient service to our day and generation; our aim must be to train men whose characters as well as their engineering achievements shall live after them." We have often in these columns endeavoured to say the same thing, and we are proud to find the President on our side. In the progress of industry "fullness of life" has too often been forgotten, and in the march of civilisation "happiness" has been less accounted than the increase in the number of amenities which purveyors can supply to the public with financial advantage to themselves. As years go on and as working hours become less and less, the proper use of leisure increases in importance. To millions of people it is in the leisure hours alone that the means of increasing the "fullness of life" can be found. In thousands of factories the daily task is a dull routine of repetition, from which the employers see no way and make no effort to redeem their workpeople. But there is—in many cases, at least—a way. A live interest in the work they are performing can be encouraged by demonstrations and lectures, and the education of the younger people may broaden their minds and give them new interests in their work and in their life. The employer who looks for the happiness of his workpeople will find it. The first necessity is that he should recognise that the finding of it is a duty which he owes to the world.

If we are in agreement with Mr. Allen on the increase of "fullness of life and happiness" we are even more cordially with him on the question of character building. We fear few employers will disagree with us when we say that the great weakness of modern systems of education is that they do not develop character, or, if that is too much to expect, that, on the one hand, they delay the natural development of character and, on the other, turn out upon the world men who are able to learn, to pass examinations, and to secure degrees, but are lacking in those human qualities that are essential to success. On looking over a list of the famous engineers of the past, one cannot help being impressed by the fact that in many cases they began their careers at an age when men nowadays are in educational swaddling clothes or ventured upon great undertakings without the guidance of science, and often with very little practical experience. They achieved success by force of character combined with that sound common sense which is the foundation of most engineering. We can give to men, now, knowledge which was not available in the past, we can relieve them from many of the hardships which their ancestors had to endure, but we cannot give them the characters which were developed by these hardships, and there are new obstacles in the way of those who desire to assume responsibility at an early age. Whether or not it is possible by any modification of our method of training and education to circumvent a tendency which is manifest as much in Germany and America as in this country, we cannot say, but we can, at least, say this, that in the workshop, thrown for the first time into intimate contact with men of a class to which he does not belong, the young engineer finds opportunities for the development of character which the schools and universities do not afford. The beginning and end of useful worldly knowledge is the knowledge of men. In helping young men to acquire that knowledge engineering firms do an incalculable service in the training of those, "whose characters as well as their engineering achievements shall live after them."

Japanese Engineering Conferences.

It is pretty widely known that two important engineering conferences are to be held in Tokyo during the autumn of next year, but it is only recently that full information about them has reached this country. One is a World Engineering Congress, organised by Kogakkai, the engineering society of Japan—formed by the federation of twelve technical societies—and the other a sectional meeting of the World Power Conference, organised by the Japan National Committee. The meetings will take place simultaneously, but the Congress will open on October 29th, whilst the Conference will begin on the following day.

The object of the World Engineering Congress is "to effect an international exchange of the latest knowledge of the sciences and practices of engineering and to bring together the leaders in research, education, and business who are directing the trend of engineering activities, thereby initiating and promoting international co-operation and understanding of engineers of the world, so essential to the advancement of the welfare of the world." It will be the first of its kind held in Japan and the Far East, and it is hoped that it will rank above other engineering congresses by reason of the wide scope of subjects covered. A tentative programme has already been drawn up. It includes not only technical meetings for discussion, but a number of excursions to the beauty spots, industrial centres, and power plants in Japan. The technical sections number thirteen, which cover practically the whole field of engineering. The Congress proper will end on November 7th, 1929, with a grand official banquet, but many excursions can be made before and after the congress, and the actual concluding date is November 22nd. The railways and shipping companies are making special arrangements for visitors, and the hospitality which is to be offered by the Japanese hosts appears to be inexhaustible. A very influential executive committee, with Baron Koi Furuichi, D. Eng., Privy Councillor, as President, and with Dr. Masawo Kamo, D. Eng., M.I. Mech. E., &c., as chairman of the Organising Committee. The Technical Secretary is Dr. Hidenosuke Sano, of Tokyo Imperial University, and the General Secretary is Mr. Shinji Yoshino, Bureau of Industry, Tokyo. The Congress is very desirous that many papers shall be contributed by British engineers. The Sectional Meeting of the World Power Conference will meet for technical discussions between October 29th and November 7th, but there will be pre-Conference excursions beginning on October 25th, and post-Conference excursions ending on November 22nd. For these excursions, as well as for those during the conferences, the members of the Conference will join with the members of the Congress, and will enjoy the same facilities and amenities. The Chairman of the W.P.F. Committee is Mr. Yasuzaeman Matsunaga, President of the Toho Electric Power Company, and the Chairman of the Reception Committee is Mr. Chokuro Kadono, vice-president of Okura and Co.

Dr. Kamo is in this country at the moment, and has taken opportunities at meetings at the Japanese Embassy and elsewhere to urge upon British engineers the desirability of taking part in these meetings personally, if possible, if not, then at least by contributing technical papers to the proceedings. It is understood that no less than two hundred and fifty American engineers will be present, and that other nations will be well represented. We are well aware that the excursion will occupy a great deal of time, some three months if the journey is made both ways by sea, and can hardly cost much less than £500 to £600 per head. But it is very important for the prestige of British engineers and of Great Britain generally that the representation at the meetings should be adequate, and we hope that it will be possible to find a number of eminent delegates who can spare the time to make the trip. We understand that the great institutions are already considering the matter, but we trust that engineers in their private capacities will also give it careful thought. In not a few cases it may be possible to arrange for business appointments to fall in the autumn of 1929, and in that way to reduce the apparent expenditure of money and time. But there are many engineers who have looked forward to a visit to Japan, and by becoming members of these congresses they will be offered facilities and will enjoy hospitality which would not be available in other circumstances. We venture to suggest to them that, as soon as may be, they shall advise their respective institutions of their intentions. Once it is appreciated that it is of real importance that Great Britain shall have adequate representation, we feel confident that difficulties which now appear great will be overcome, and that the British engineers who accept the invitation of the Japanese hosts will be sufficient in number and position to represent properly the great industry to which they belong.

Some Impressions of the Fleet.

During the present month we have had exceptional opportunities of watching the Navy at work, and we believe that some of the impressions gathered during a week's cruise with the Atlantic Fleet in Scottish waters will be of interest to our readers. It has always been our conviction that every critic of naval affairs, whether from the technical or the political aspect, should from time to time refresh his knowledge by personal contact with the Navy itself. This may seem a platitude, yet the fact remains that there are writers who, judging from what they write, rarely, if ever, board one of his Majesty's ships, let alone go to sea in such a vessel to observe for themselves what the Navy actually is, what it is doing, and why it is doing it. This is a privilege which cannot, of course, be extended to everyone; but, thanks to the sagacious policy of the present Board of Admiralty, it is now granted more readily than heretofore to the properly accredited naval student. The occasion in question was of particular interest, in that it coincided with some of the most important phases of the autumn programme of fleet training. We would like here to express our pro-

found appreciation of the most courteous treatment which we received from the Admiralty, from the Commander-in-Chief of the Atlantic Fleet, and from the officers of the several ships in which we were temporarily accommodated.

The Fleet itself was practically at full strength, the only notable absentee being the "Iron Duke," erstwhile flagship of the Third Battle Squadron, which is undergoing a large refit at Portsmouth. Eight capital ships were present, among them being the mighty "Nelson" and "Rodney," the still larger "Hood," and the sister battle-cruisers "Renown" and "Repulse." The Fleet Air Arm was greatly in evidence, for in addition to the aircraft borne in the "Furious" and "Argus," machines from the R.A.F. station at Novar took part in the exercises. It is no secret that the Navy is short of cruisers, a deficiency made manifest by the composition of the only cruiser squadron—the Second—attached to the Fleet. Its flagship is the "Vindictive," a unit of the "Hawkins" class, which was originally completed as an aircraft carrier and has since been re-converted, the other three ships of the Squadron being the "Canterbury," "Cambrian," and "Comus," all of which saw hard service during the war and will soon have passed the limit of effective life. Though by no means devoid of fighting value, vessels of this type are too small and of too limited a radius to be employed on the ocean routes. The new Australian cruiser "Canberra" arrived in Cromarty Firth towards the end of our visit, unfortunately too late to take part in the operations which we witnessed. She is identical with the Royal Navy cruisers of the "County" class, whose splendid nautical qualities have already become proverbial throughout the service. The "Hawkins" class is, of course, of much older design, dating from 1916, but having spent a day in the "Vindictive" in Moray Firth in half a gale of wind, we can testify to the splendid behaviour of these ships in a seaway. They are wonderfully steady gun platforms, their motions in a rough sea being considerably less lively than those of certain passenger liners, of much greater displacement, which we could name. In addition to the larger vessels mentioned, we made short cruises in destroyers of the Admiralty "W" class and a submarine of the later "L" class.

Conspicuous among the ships, great and small, that were anchored in Cromarty Firth was the ex-battleship "Centurion," now fitted out as a target ship. To those who love ships for their own sake she presents a rather melancholy spectacle. All the big guns and much of the top hamper have been removed, and seen at a distance she gives the impression of being a useless derelict hulk. Any such idea, however, is entirely misleading. We were told, and could well believe, that the "Centurion" in her new *rôle* is of more value to the Navy than if she were a fully equipped battleship. Thanks to her, the gunnery practice of the Fleet can now be conducted under the most realistic conditions. By an elaborate system of wireless control, into the details of which we do not propose to enter, this great ship of 24,000 tons, without having a soul on board, can be made to simulate all the movements of a fully manned ship. When she is required to act as a target her officers and men go on board the destroyer "Shikari," in which vessel duplicate control positions are installed. Radio waves from the destroyer actuate motors in the "Centurion" which regulate the main steam valves, the supply of fuel oil to the furnaces, and the movements of the helm. By this means the deserted battleship can be made to steam ahead at speeds up to 16 knots, to go astern, or to stop; to turn so many degrees to port or starboard, and to send up a smoke screen such as a ship in action might put up to blind the hostile gunners. The ordinary battle practice target can do none of these things, and owing to its lack of stability it can only be towed at low speed. Hence the value of such a ship as the "Centurion," which enables our naval gunners to practise shooting under conditions which closely resemble those of actual warfare.

The crew of the "Centurion" may be said to lead double lives. Officers' cabins and seamen's quarters are in duplicate, one set being above the waterline, the other below. Before every "shoot" all personal effects and portable furniture are removed from the upper to the lower quarters, where they are protected by the stout belt armour. When the practice is over they return to find, as a rule, the whole upper part of the ship in a state of ruin. On the day of our inspection the ship had just come through a particularly severe bombardment. It is no exaggeration to say that her sides above the main belt were riddled like a sieve. Not a single sensitive point had escaped shells or splinters. Apart from damage on the lower deck there was a scene of utter havoc in those very places where officers and men would congregate in action. Every storey of the bridge and its screens was ripped with flying fragments of metal. The foremast had received several direct hits, and the foretop had sustained the full force of a direct burst. The sick bay, the captain's cabin, and all save one of the officers' cabins had been laid waste. On the armoured deck there were gashes and furrows beyond counting. We will say nothing of the numerous direct hits which, had they been inflicted by fully charged shells, must have caused severe injury to material and *personnel*. Looking at this scene of devastation, we were thankful that the views of the anti-armour school have not prevailed in our latest ships. We hope, and believe, that the object lesson taught by the "Centurion" after every bombardment will not only tend to improve the quality of the Fleet's naval gunnery, but will exercise a salutary influence on the design of our future men-of-war. We have no hesitation in affirming that so long as a ship is liable to be exposed to the fire of guns of any considerable calibre, adequate armour protection to every vital position is indispensable. Should there be any who question this dictum, we would invite them to inspect the "Centurion" at the end of a day's "shoot."

During recent years no technical question has been more hotly discussed in naval circles than the design of the "Nelson" and "Rodney." Superficially, at any rate, they transgress all the accepted canons of naval architecture, but having seen them "in action" one conceives for them a new respect as fighting machines. We watched both ships engage in a full-calibre shoot with their 16in. turrets at a range that would have seemed fabulous not so many years ago, and, having enjoyed the scenic effect of the tremendous flash and the billows of tawny cordite smoke, we turned our glasses on the target just in time to see the mighty water spouts that denoted the arrival of the huge shells. A heavy sea was running at the time and visibility was none too good, yet almost every salvo was a "straddle," though the range, we are permitted to say, was approximately twelve miles. Later in the same day we saw the ships of the Second Cruiser Squadron take under rapid concentration fire a target distant at a range considered, before the war, to be impracticable even for heavy guns. On this occasion, however, only 6in. guns were at work, and within less than a minute the target was literally hidden from view by the "overs" and "shorts" of straddling salvos. It is certain that no ship other than a heavily armoured capital unit could have survived this torrent of projectiles. It is equally certain that British naval gunnery has made so much progress since the war that bases of comparison between the performances of 1918 and 1928 can scarcely be said to exist. We should add that the results recorded above were the more impressive in that they were achieved in very difficult circumstances, the firing ships being under helm at the time, while the range, course, and speed of the target were unknown quantities.

If space permitted we would like to give some description of our day in H.M.S. "Furious," the ship in which the flying-off and on of aircraft at sea has been reduced to a fine art. The amazing celerity with which groups of machines are brought up from the hangars, projected into the air, and received on deck after flight must be seen to be believed. Simplicity is the keynote of the whole system, but the results are not the less impressive on that account.

Summing up our impressions of a week crowded with variegated experiences, we would say that the Navy is doing its utmost to justify the trust reposed in it by the nation. If professional zeal and hard work are the criteria, we have no hesitation in placing it first among the departments of the State.

Literature.

Marten Triewald's Short Description of the Atmospheric Engine. Published at Stockholm, 1734. Translated from the Swedish. London: The Newcomen Society.

Soon after the Newcomen Society for the Study of the History of Engineering and Technology was founded, it was decided by the Council that from time to time the Society should publish reprints of famous historical works that are not generally accessible. In selecting "Triewald" for its first venture of the kind, it has done a real service to all who take an interest in the history of engineering. Only three copies of the work exist in London; one at the Royal Society, one in the British Museum, and the last—that used for the present translation—in the Patent Office Museum. They are all in Swedish, and as far as we know no complete translation has heretofore appeared. It is now presented in as close a facsimile of the original as possible, the actual title page and the folded plate being admirably reproduced. The translation, which has been very well done by Mr. Are Waerland, corresponds as far as possible page for page with the original, and an excellent type on a rough paper helps, with copies of the original head and tail pieces, to maintain the spirit of antiquity. Altogether a very desirable volume.

Triewald was born in 1691, the son of a smith. He was educated at Upsala, and when he was twenty-five years of age he came to England and remained in this country for ten years, attending to the building and working of Newcomen engines and lecturing. The erection of a Newcomen engine at Dannemora mines occurred soon after his return to his own country, and a few years later the book which is before us was published. Its full title, in English, is: "A Short Description of the Fire—and Air—Machine at the Dannemora Mines." It will be seen from these few facts that Triewald was well qualified for the task he undertook. He appears to have had a good conceit of himself and had something of that air of superiority which the college man sometimes has in his attitude to mere mechanical engineers. We may illustrate this by an amusing passage. He is telling again the old story of how the water jet for condensation was discovered, and says: "Though somebody might think that this was an accident, I, for my part, find it impossible to believe otherwise than that what happened was caused by a special act of Providence. To this conclusion, I—who knew personally the first inventors—have been brought more than ever when considering that the Almighty then presented mankind with one of the most wonderful inventions which has ever been brought into the light of day, and this by means of ignorant folk who never acquired a certificate at any University or Academy." The astonishment of the superior man is here evident. He knew "personally the first inventors," mere "ignorant folk," who had had no technical training. Impossible to believe that they could do anything notable without the direct intervention of Providence. He leaves us almost to suppose that if only he had been present when Newcomen was making his early trials, he would at once have proposed the solution which Providence had, in the lack of a University or Academy man, to present in the form of an accident to the inventors.

However, we must not grudge Triewald his self-satisfaction. Like many another scientist, he was wise after the fact, and he was amongst the first—Desaguliers, who was his professor, must not be forgotten—to study the atmospheric engine scientifically. It is, however, difficult to believe that there was such ignorance about the part played by the atmosphere in action of the Newcomen engine as his statements imply. Possibly his little book was intended primarily for the general public, for company promoters, and potential purchasers, and that it was for them that he described, with considerable skill and lucidity, the theory of atmospheric pressure.

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Motor Car Show at Olympia.

No. III.*

Other Cars in the "Baby" Class.

The new "Baby" car shown by the Triumph Cycle Company, of Coventry, for the first time at Olympia possesses one or two features which are not found in other cars of the same class, but it is rather more expensive. The four-cylinder engine has side-by-side valves, thermo-syphon cooling with fan, pressure lubrication to all main bearings, magneto ignition, three forward speeds, central change, single plate clutch, worm drive and hydraulic internal expanding four-wheel brakes on the Lockheed principle. The bore and stroke of the engine are 56·5 mm. and 83 mm. respectively, and the Treasury rating is 7·9 horse-power. The timing mechanism is chain driven and the cylinders have Ricardo heads. The crank shaft has three bearings and the wheel base is 6ft. 9in.

The "Singer Junior" has a Treasury rating of 7·78 horse-power, the bore and stroke being 56 mm. and 86 mm. respectively. This engine has overhead valves. Brakes of the hand-operated variety are applied to all four wheels. The wheel base of this car is 7ft. 6in. and the track 3ft. 6in.

The Jowett car, which is also in the "Baby" class, has only two horizontal opposed cylinders, 75·4 mm. bore by 101·5 mm. stroke, the cubic capacity being 907·2 c.c. and the Treasury rating 7 horse-power. This car was shown with two lengths of wheel base, 8ft. 6in. and 7ft., the width or track being 3ft. 9in. The engine is cooled on the thermo-syphon principle, and there are three forward speeds and a reverse. Four-wheel brakes, hand lever operated external band, on the front and rear hubs, are fitted.

The 7 horse-power four-cylinder Peugeot has the smallest Treasury rating in this class, namely, 6·4 horse-power, the cylinders being 51 mm. and 85 mm. bore and stroke. The engine has side by side valves, thermo-syphon cooling and lubrication on the pump and splash system.

Something novel in body work was shown in the Singer Junior sunshine saloon—Fig. 18. In this saloon the hood is opened and closed by means of a handle which is placed between the driver's seat and the offside door. The hood is self-locking, and the whole structure is rigid whether open or closed. It can be raised or lowered while the car is in motion. The apparatus for operating it consists of a continuous tube or channel, along each side of the car, which passes along the "cantrail," down the windscreen and front door pillar to the floor, and thence to the back of the car, to join up with the cantrail at the height of the waist line. An endless chain runs in each of these continuous tubes, and a lateral steel shaft, free to revolve underneath the front seats, has a chain sprocket at each end, engaging with endless chains. This shaft is driven by a simple winding gear at the side of driver's seat. Engaged with the cantrails is a series of slippers, which are free to move along it. There is a pair of slippers for each of the two intermediate hood sticks, and one for the peak on each cantrail. Each series of slippers is connected with steel pulling links, so that when the front slipper is connected to the chain with a simple forked connector, the slippers will move along each cantrail if the shaft is revolved by winding the handle. Each intermediate hood stick is mounted upon a pair of slippers each side, by means of arms. These arms have universal joints, so that each hood stick will pass over the varying widths between the cantrails, when the hood is raised or lowered. The peak is joined to its slipper by means of an arm having universal joints, so that this also can pass over the wider parts of the body. To each peak slipper is attached a simple trip which raises or lowers the peak so that the hood material is not in tension until the hood is finally up. A clip is also attached to the peak each side, so that it is self-locking and self-releasing. The peak also engages a draught stopper along the top of wind screen. Both the pulling links and the arms to the slippers are so constructed that they fold with the material of the hood when they reach the back of the body in lowering the hood. The edge of the cover, when up, enters into a deep gutter at the cantrail and is held there by a cable. This is adjustable, as are the hood sticks for width and the chains for stretch. The provision for self-locking is also adjustable.

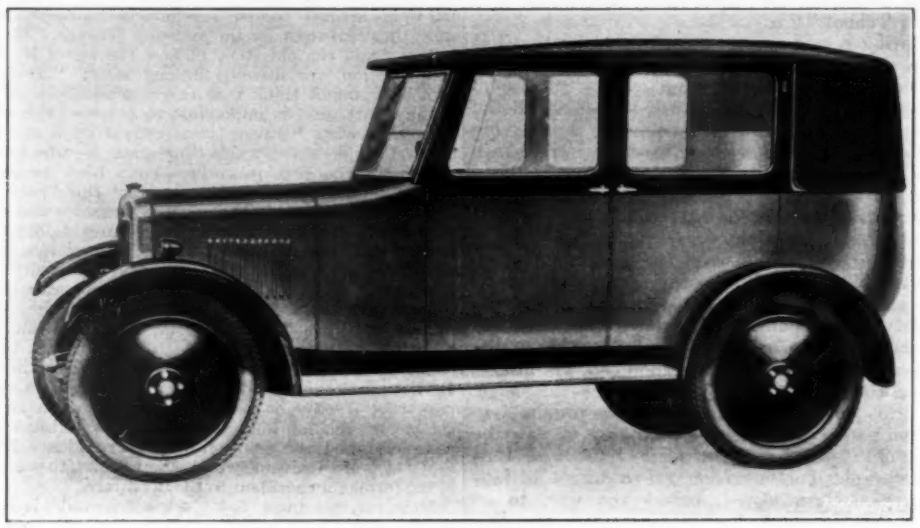


Fig. 18—Singer "Junior" Sunshine Saloon

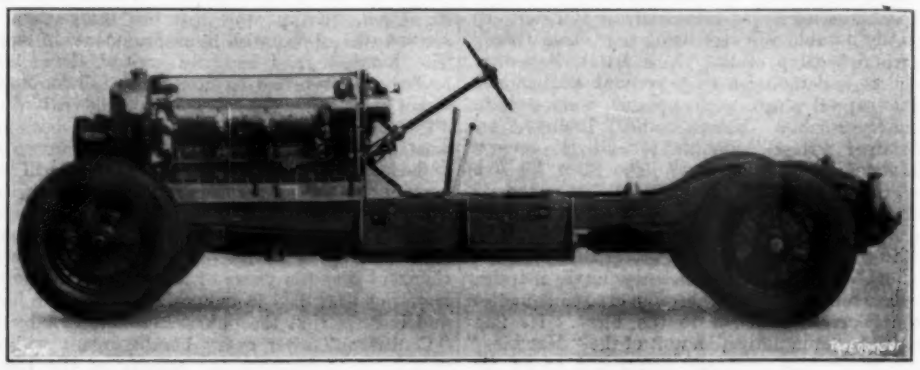


Fig. 19—Bentley 6½ Litre Six-Cylinder Chassis

Bentley.

The programme of Bentley Motors, Limited, for the coming year includes two 3-litre models, one for ordinary work and one for speed work, a 4½-litre model, and a 6½-litre speed model. A view of the chassis of the large chassis is given in Fig. 19. The construction of this chassis resembles that of the standard chassis, but the engine has a higher compression and is fitted with special twin S.W. carburetters. The back axle ratio is 3·3 to 1 for open cars and 3·5 to 1 for Weymann saloons. The wheel base is 11ft. 6in. A new design of radiator is incorporated in this model. The cylinder dimensions are 100 mm. bore by 140 mm. stroke, the Treasury rating being 37·2 horse-power. There are four valves per cylinder. They are of the overhead type. The water circulation is by pump, and it is controlled by a thermostat. Dual ignition by M.L. magneto and Delco 12-volt coil is fitted. The transmission is by a single plate clutch to a four-speed gear-box and final spiral bevel drive. The brakes are on the Dewandre servo-operated principle.

Alvis.

The Alvis Car and Engineering Company, Ltd., in addition to its standard four and six-cylinder cars, showed a sporting car, the front wheels of which are the drivers, and all four wheels—drivers and driven—are independently supported and sprung. The great feature of this system of front wheel driving is that the motive force is always applied to the wheels in the direction in which the car is desired to travel. By moving the steering wheel the driver not only changes the direction of the front wheels but the direction of the propelling force, and the makers claim that corners can thus be taken at much higher speeds than is safe with ordinary rear-wheel driven cars. Views of the power unit, and of a complete car, and a plan of one of the chassis are given in Figs. 20, 21 and 22. The

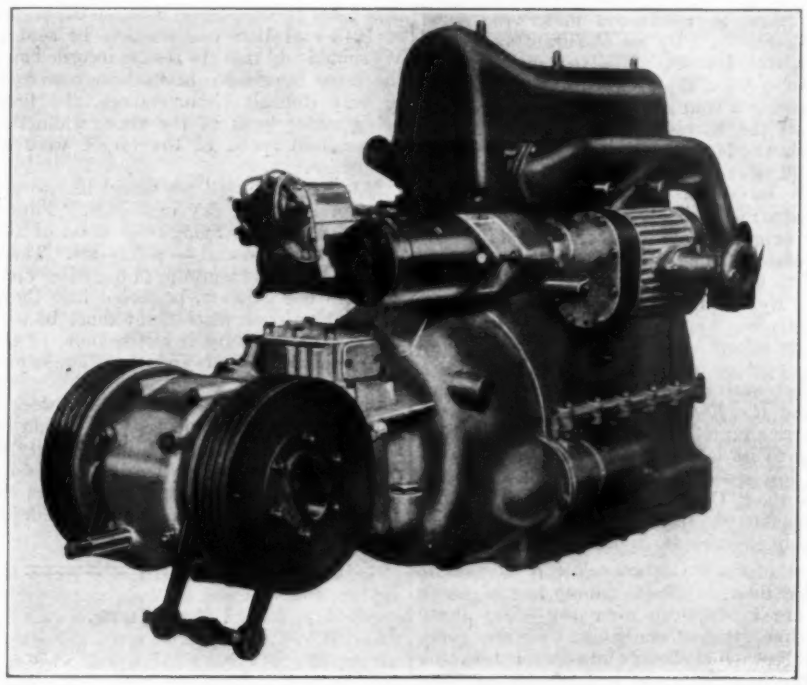


Fig. 20—Alvis 12-50 H.P. 4-Cylinder Front-Wheel-Drive Engine

* No. II. appeared October 19th.

engine is of the four-cylinder high-compression type, 68 mm. bore by 103 mm. stroke, with a cubic capacity of 1481 c.c. It has a detachable cylinder head, large water spaces, and overhead valves operated by a gear-driven overhead cam shaft. The crank shaft is carried in three bearings, is machined all over, and is fitted with counterbalance weights, while the pistons are of special aluminium alloy of very strong design to stand up to the high stresses necessitated by supercharging. The crank case has a semi-dry sump and lubrication is by means of a rotary gear pump providing forced feed to the crank shaft, big end bearings, hollow cam shaft bearings and to each individual cam. The engine is fitted with a supercharger of the blower type, which is mounted and driven by the same horizontal shaft that operates the dynamo. The connecting-rods are of duralumin with white metal linings pressure cast in position. The carburetter is of Solex manufacture for supercharged engines and there is a special "hot spot" induction system. The magneto is of the polar induction type and power is transmitted to the gear-box through a single plate clutch provided with a clutch stop. The gear-box, which is of unit construction with the clutch housing and crank chamber, provides four forward speeds and a reverse, and the final drive is by straight tooth bevel gears of nickel-chrome case-hardened steel. The makers state that this form of gear, while not as silent as the spiral bevel, is found to be considerably more efficient when maximum performance is required, as when racing. It will be observed in Fig. 22 that the engine and transmission gear are placed in the chassis in the reverse direction to that which is customary and that each of the front driving wheels is separately sprung. In addition, each wheel is separately controlled by the steering gear. The independent springing of these wheels, which contributes largely to the perfect operation of the front-wheel drive, was an incident in the evolution of the final design. By constraining the wheels to move in a vertical plane, gyroscopic tendencies as well as the complicated behaviour due to the action of front-wheel brakes are eliminated. It will be observed that the front wheel suspension system embraces two sets of short cantilever springs which are secured at their inner ends to the chassis frame. Each of the rear wheels has also its own separate leaf springs, which are held by means of strong levers pivoted about shafts at the rear of the chassis. In this way the wheels can move up and down and adapt themselves to the unevenness of the roads independently. The final transmission of power to the front wheels is by means of two short universally jointed cardan shafts, the stub axles being carried by the transverse quarter elliptic springs so that no axle beam is required. These cars have done some remarkable performances in competitions, and we are informed that no trouble has been experienced with the front-wheel-drive principle.

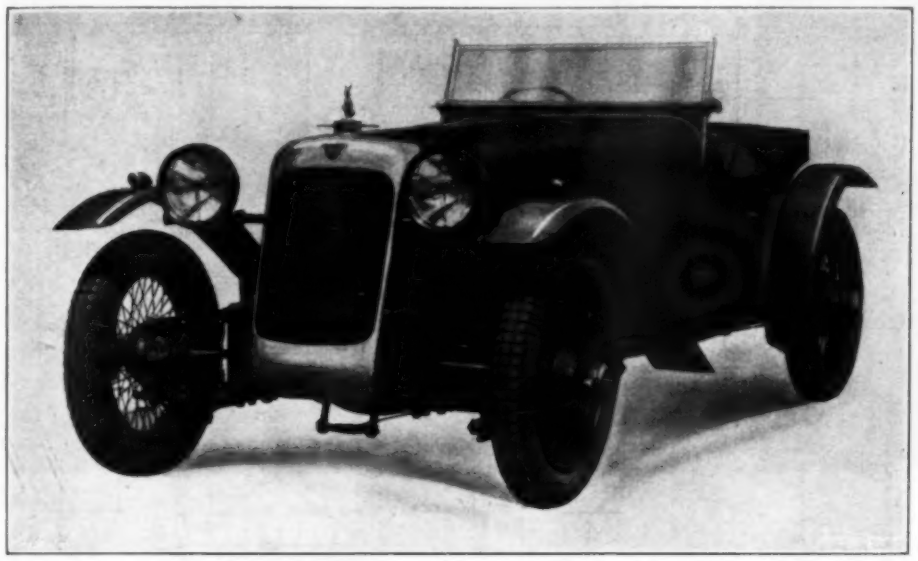


FIG. 21—ALVIS FRONT-WHEEL-DRIVE CAR

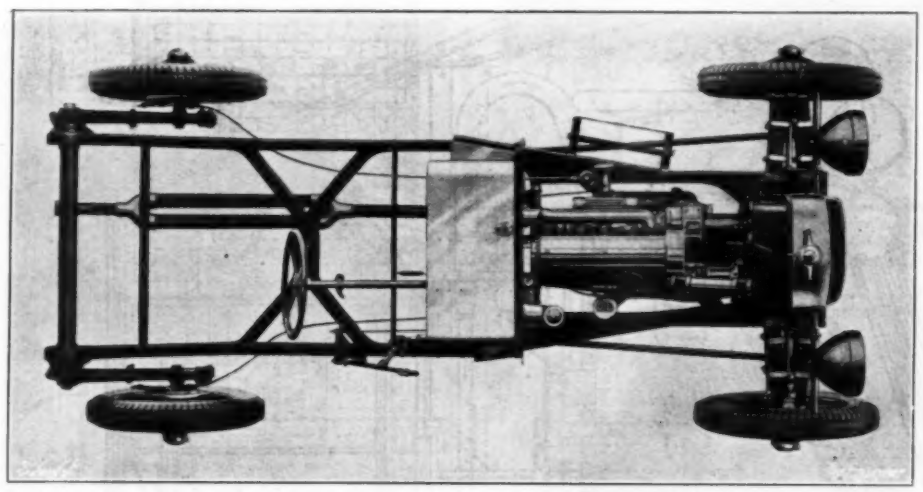


FIG. 22—ALVIS, PLAN OF FRONT-WHEEL-DRIVE CHASSIS

Eight-cylinder Engines.

That eight-cylinder engines will have to be reckoned with in the near future is demonstrated by the number of different makes of this type of engine that were exhibited. In all we counted no fewer than twenty-five, and a dozen of these "straight eight" chassis are quite new, five being British, four American, and three from the European Continent. We have already referred to the Lanchester productions. Other firms which were showing units of this size were Arrol Aster, Wolseley, Beverley, Renault, Mercédès, Benz, Bianchi, Ballot, Moon, Studebaker, Panhard, and Bugatti. Of the engines only one is fitted with sleeve valves, and that is the Arrol Aster. The Wolseley "eight" has cylinders 80 mm. by 100 mm. bore and stroke respectively, and has a Treasury rating of 32 horse-power. It has overhead valves, detachable cylinder head, and the valves are operated by an overhead cam shaft driven by spiral bevel gears. The crank shaft is supported by nine bearings. The gear-box gives four road speeds and the engine clutch and gear-box are suspended at three points. Cooling is on the thermo-syphon system assisted by an impeller. Ignition is by means of a high-tension magneto.

Austro Daimler.

One of the most interesting chassis in the Show was that of the 21·6 horse-power six-cylinder Austro-Daimler car shown by A.D. Motors, Ltd., 18, Great Portland-street, London, W. 1. The special feature of this chassis is the original design of the frame, which comprises a centrally disposed steel tube of large diameter with forked steel pressings enveloping the forward end and providing a mounting for the engine, radiator, &c. The rear end of the tube carries the back axle unit. The makers claim that the use of the tubular chassis, combined with the independent suspension of the rear wheels, is entirely novel and allows of a construction which gives the greatest strength, no distortion of the coach work, an extremely low centre of gravity, saving of weight and a design in which all the moving parts are enclosed. The rear wheels are independently sprung by transverse cantilever springs. The engine cylinders are 76 mm. bore by 110 mm. stroke, the cylinder block, water jacket and top half of the crank case being in one casting of "Silumin" with pressed in cylinder liners. The overhead valves in two rows are operated through rocker arms by an overhead cam shaft driven by a vertical shaft at the fly-wheel end.

Humber.

The Humber Company's programme for 1929 includes four models, the 9–28 horse-power four-cylinder, the 14–40 horse-power four-cylinder, 16–50 horse-power six-cylinder, and 20–65 horse-power six-cylinder cars. All of these except the 14–40 horse-power car are new in construction and design. The engines of each possess a new turbulent "non-pinking" head in which the combustion chamber is machined all over. Superimposed valves are retained, but the whole lay-out is different from that of previous models. The inlet valves are inclined to give compactness to the space occupied by the gases and a higher compression ratio. The sparking plugs are on the exhaust side and are close up to the main body of the gases when the firing point is reached. This causes a quick burning of the gases. The 9–28 horse-power engine is mounted at four points direct on the frame. The 14–40 horse-power unit is mounted on a sub-frame, having trunnion blocks at the rear supports with friction damping and double spring suspension at the front, while both the six-cylinder units are mounted on a sub-frame and supported at four points on rubber mountings. The lubrication of the engines is well arranged. The cam shaft, which lies in an oil-containing tunnel formed in the crank case, has four bearings, which are fed by a high-pressure system, just as are the main engine bearings. In the six-cylinder engines the forward part of the sump reservoir is cast with a false bottom and the after part possesses a baffle plate to prevent the oil pouring forward when the car is descending gradients. The carburetters are of the horizontal twin pattern. In the six-cylinder cars the braking systems are of the most recent type. In the 16–50 model self-energising brakes are fitted to all wheels. They are of the Bendix-Perrot three-shoe type and easily adjusted. In the 20–65 model the front wheel brakes are on the Humber-Perrot system, all shoes being of the expanding kind, and a Dewandre vacuum servo motor is mounted at the side of the gear-box. We noticed that, in the 20–65 model, rubber bushes are fitted to the spring eyes and shackles, so as to dispense with lubrication and to insulate the body from road noises. The coachwork on all these cars is of the high quality usual in Humber cars.

Daimler.

The several exhibits of the Daimler Company included:—(1) A "Double-Six" "50" enclosed limousine. It has a sleeve-valve engine, 81·5 bore by 114 stroke—Treasury rating 49·4 H.P.—two automatic carburetters, automatically governed dual ignition, Lanchester vibration damper, and a single disc clutch with fabric lining, four speeds forward and reverse. (2) A 35–120 H.P. six-cylinder enclosed landaulette, with a sleeve-valve engine, 97 bore by 130 stroke—Treasury rating 35 H.P.—Daimler automatic carburetter, automatically governed dual ignition, Lanchester vibration damper, and a single disc clutch with fabric lining, four speeds forward and reverse. (3) A "Double-Six" "30" saloon, with a sleeve-valve engine, 65 bore by 94 stroke—Treasury rating, 31·4 H.P.—two automatic carburetters, automatically governed coil ignition, Lanchester patented vibration damper, single disc clutch with fabric lining, four speeds forward and reverse. (4) A 25–85 H.P. six-cylinder enclosed landaulette, with a sleeve-valve engine, 81·5 bore by 114 stroke—Treasury rating, 24·7 H.P.—and (5) a 20–70 H.P. six-cylinder enclosed limousine, with sleeve-valve engine, 73·5 bore by 104 stroke—Treasury rating, 20·09 H.P. No drastic modifications have been made in either the chassis or complete cars.

Rolls-Royce.

This company is adopting a conservative policy with regard to the engineering features of its cars, which show no material alterations from those of last year. They include a 40–50 horse-power six-cylinder chassis, with cylinders 4¼in. bore by 5½in. stroke, and a Treasury rating of 43·3 horse-power. Overhead valves operated by push rods, detachable heads, pump water circulation, pressure lubrication and dual ignition are standardised throughout. The transmission is by single dry plate clutch, four-speed gear-box and spiral bevel final drive. The smaller chassis has an engine with 3in. bore by 4½in. stroke, and the Treasury rating is 21·6 horse-power. The transmission resembles that of the larger chassis.

(To be continued.)

Powdered Fuel at a Colliery.

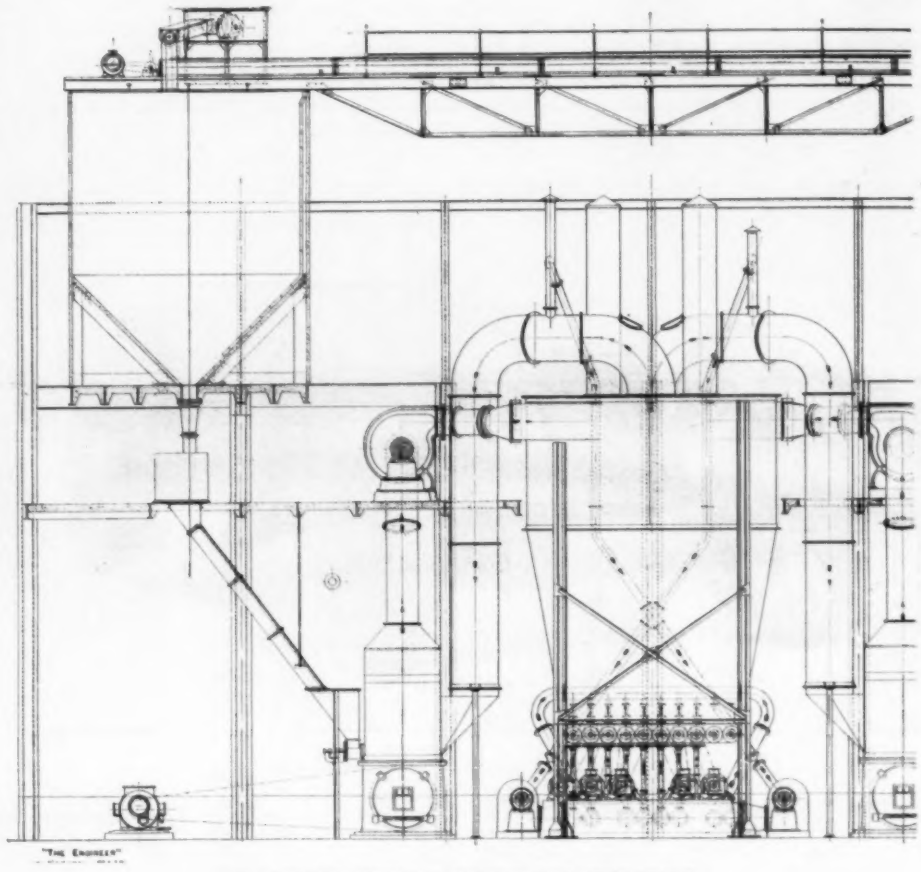
We have recently referred to the efforts which are being made by some of the British collieries towards the more efficient management of their own affairs and the provision of a class of coal which is really acceptable to the purchasers. This tendency is well exemplified at the pit, near Doncaster, of the Denaby and Cadeby Company, where several modern appliances have recently been installed. But it is our purpose only to describe at the moment the plant which has been laid down for the burning to a useful purpose of what would otherwise be a nuisance—that is to say, the refuse from the cleaning plant, which has such a low market value that it will not justify transport to any distance. This object has been achieved by the burning of practically all that waste in the powdered form, and the plant, described below, is, we believe, serving its purpose so usefully that, apart from providing the steam required for the service of the pit, it is now looked upon by those in charge of the coal-screening plant as the so obvious outlet for waste, that in the event of the boiler requirements falling below the normal, they are aggrieved that all the steam that they can produce cannot be absorbed.

The whole of the new powdered fuel plant at the Cadeby pit has been supplied by the Fraser and Chalmers Engineering Works, at Erith, Kent, of the General Electric Company, Ltd., and it operates in conjunction with three water-tube boilers, by John Thompson and Co., of Wolverhampton. The general arrangement of one of these boilers is shown in the drawing below, while the lay-out of the firing plant is represented in the other drawing and engravings. The normal steaming capacity of each of these boilers is 30,000 lb. per hour with an overload capacity of 45,000 lb.

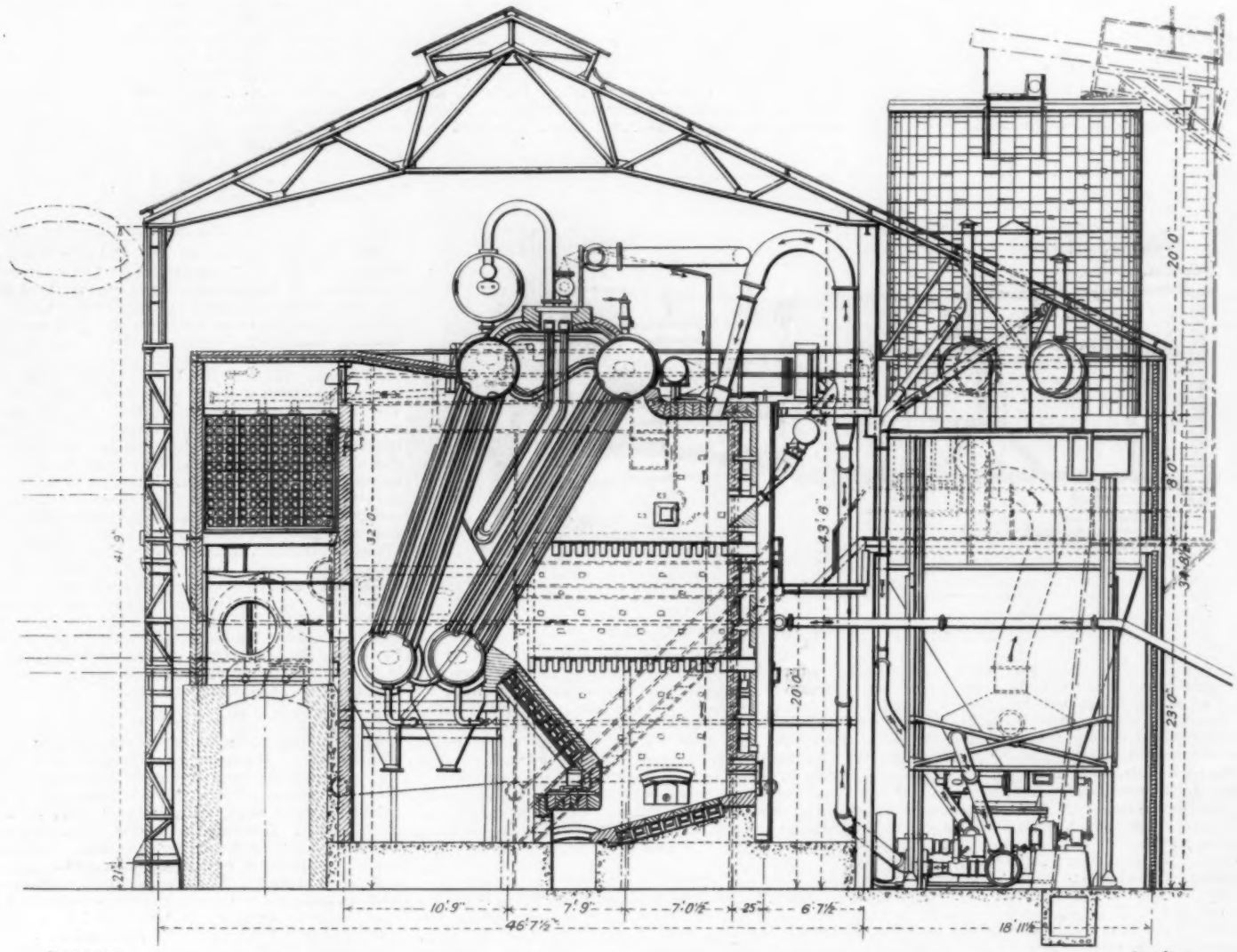
Two broad principles are involved in the scheme of the plant. One is the duplication of practically every moving item, so that there is little likelihood of failure in the continuity of the supply of steam, and the other is the provision of a store of pulverised coal which may be drawn upon for immediate requirements, regardless as to whether the pulverisers are working or not.

The coal, from the cleaning plant, which has a calorific value of about 10,600 B.Th.U., an ash content of some 23 per cent., and about 3·9 per cent. of moisture, is brought to the boiler-house by means of a belt conveyor. It ranges in size from ¼in. mesh down to fine dust, and is taken by a screw conveyor to either one of two overhead silos in the boiler-house. There is also an alternative supply of coal, by an elevator, from the railway siding, which feeds into the opposite end of the screw conveyor. For this reason the conveyor has been made reversible, so that it can feed either silo from either end. The flights of this conveyor are not fixed on to the shaft by the common manner of using brackets, but are welded in place, so that both faces provide an equally good surface for the propulsion of the coal.

The silos, themselves, are of rather unusual design, and remind one very much of a cooper's work, and are built of flat slabs of concrete, measuring 30in. by 12in. by 2½in. thick. The slabs are tongued and grooved, and are bound together by hoops tightened by screw lugs. Each silo measures 20ft. high by 16ft. in diameter, and is capable of holding about 50 tons of raw coal. one of them can be seen protruding through the roof in two illustrations of the boiler-house. These silos



PULVERISER, STORAGE HOPPER AND FEED GEAR



GENERAL ARRANGEMENT OF BOILERS AND POWDERED FUEL PLANT

The two silos provide a storage of coal for supplying two pulverisers, which, in turn, feed a hopper common to the three boilers at present installed—provision has been made for the addition of a fourth boiler.

The pulverisers are of the roller type, that is to say, the coal is pulverised by the action of more or less free rollers running round within a fixed casing. We illustrate a set of these rollers, together with the rotor which drives them, and it will be noticed that the rotor has plough-like faces which gather the coal into the path of the grinding rollers. The rollers and their path obviously suffer the most wear and tear in pulverising the coal, while the rotor is the only other part of the machine subject to serious abrasion. These three parts are, therefore, made of cast steel and are readily replaceable.

The coal is fed in between the rollers and their path, and is, naturally, ground up to an indeterminate degree of fineness, but it is immediately classified by means of a draught of air. Above the pulveriser there is a large separator, which is connected at the top with an exhaust fan. The suction of this fan is so regulated that it will just carry away fuel of the desired fineness, which, in this case, is such that 80 per cent. will pass through a mesh of 180 per inch. Any stuff which has not been ground so fine falls back into the grinding zone through an internal hopper.

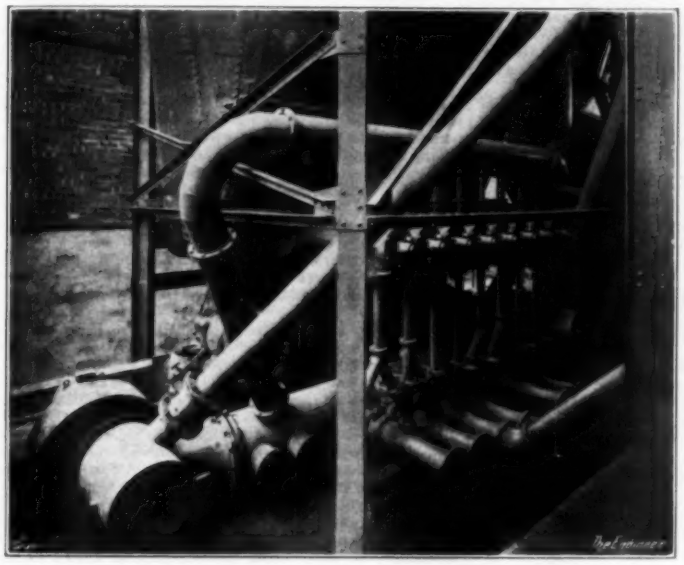
The two pulverisers discharge by means of their fans into the common hopper, which has a capacity of 70 tons, and is made of steel plate. At the bottom of the hopper there is a row of screw conveyors for supplying the powdered coal to the boilers, as shown in our engravings. These screws are 10in. in diameter and are driven by variable-speed electric motors through chain gearing. The conveyors and their motors are grouped together in such a manner that during normal working six screws, driven by three motors, will supply the three boilers with fuel, while their are two screws, each worked by its own motor, as standby. These safeguards are so arranged between the normal running units that they may be utilised to assist any one of the others in case of emergency. Each of the screws is equipped with a revolution counter of the integral type, for recording purposes, and the motors are controlled by means of rheostats on the firing platform in front of the boilers, so that the rate of feed may be regulated to the immediate requirements of the boilers.

In this connection we were interested to notice the attention which the attendants gave to the regulation of the fuel feed to the boilers, as, during the whole period of our visit, there was no sign of blowing off at the safety valves, or, on the other hand, any appreciable drop in the steam pressure. The new boilers, in conjunction with nine Lancashire boilers, have to supply the steam for the power plant and the two winding engines of the colliery, and the demands of the winding engines may rise to as much as 220,000 lb. of steam per hour, in the event of both engines starting together, and, within a minute, may be reduced to nothing. Again, the daily consumption of steam ranges between about 25,000 lb. and 65,000 lb. per hour, when based on an hourly average. There seems, however, to be no difficulty in maintaining a good steady head of steam in these conditions. The CO_2 content of the flue gases is also kept remarkably constant, regardless of the demands imposed upon the boilers, and is, we believe, about 11 per cent. A higher percentage could be maintained, but Mr. Hardy, the colliery engineer, has found that any appreciable increase is attended by such high furnace temperatures that the cost of replacing refractory material more than counterbalances the economy of fuel.

The course of the powdered coal from the regulating feed screws to the burners needs little description, as it is effected in pipe work by means of injectors. These injectors provide about one-third of the air necessary for the combustion of the fuel in normal full load operation, and the balance is supplied at the furnace top, where the burners are situated. This secondary air is pre-heated by being passed through cavities in the brickwork lining of the furnace. There are, of course, occasions of light load when the draught necessary to keep the coal travelling through the fuel pipes is perhaps sufficient to support combustion, and in such cases the air used for cooling the furnace walls is spilled away to waste.

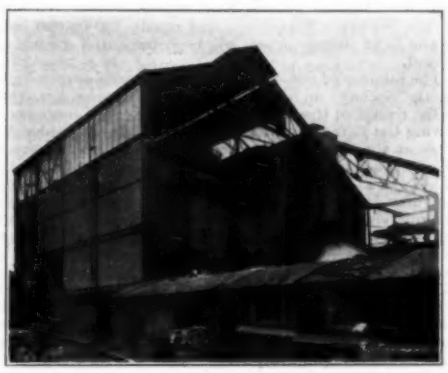
The burners, a pair of which we illustrate, are of the Hay type, and are notable on account of the low velocity of the flame which they produce. They project the flame downward into the top of the combustion chamber, and are fitted with long flaps, or lips, by means of which both the length and the direction of the flame can be regulated while the boiler is in operation. By these means it is possible for the attendant to minimise the accumulation of slag on the combustion chamber walls. The ash falls down into the bottom of the combustion chamber in the form of small particles and is taken away by a drowned scraper conveyor to the railway siding.

Complete details of the trial runs of this boiler plant are not yet available, but we understand that they show that the consumption of power for the handling of the coal, from its arrival at the boiler-house, in the raw state, to its burning in the furnaces, amounts to 13 kilowatts per ton. The actual power consumption may be gauged from the fact that the equipment includes two 75 H.P. motors for the pulverisers, two 30 H.P. motors for the exhauster fans, eight 2 H.P. motors for the feed screws, two 15 H.P. and three 25 H.P. fans for the primary and secondary air supplies respectively, and a 4 horse-power motor for the ash conveyor. Several of these motors are, however, installed as stand-bys.



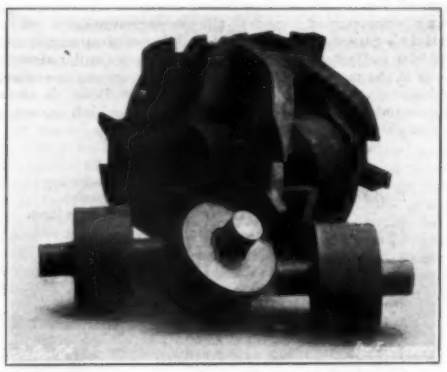
INJECTOR SIDE OF FUEL FEED

DRIVING SIDE OF FUEL FEED

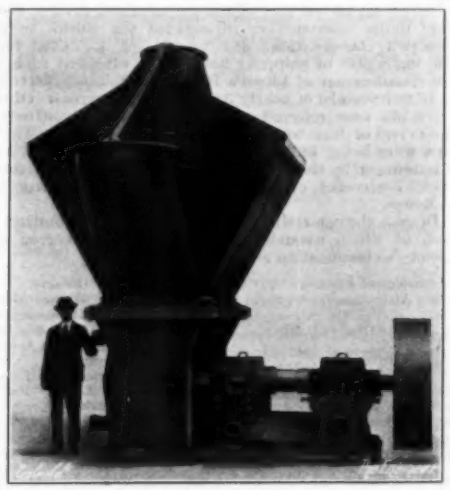


BOILER-HOUSE

TWO BURNERS



PULVERISER ROTOR AND ROLLERS



PULVERISER AND SEPARATOR

Lloyd's Register—Annual Report.

LLOYD'S REGISTER Annual Report for the year 1927–28 has recently been published. It is, as usual, a voluminous document, which is too extensive for us to reproduce in full, and we propose, therefore, to follow our custom of past years and give extracts from it in what follows. It is stated at the outset that the Society's operations during the year showed a marked increase over those of the previous year, which is attributed to two main causes. In the first place, during the year 1926–27 shipbuilding and the allied industries of this country experienced a severe depression, owing to the stoppage caused by the coal dispute. A large portion of the work which, but for that interruption, would have been included in that year was only completed during the current period, and swelled its production of tonnage accordingly. In the second place there arose, both in this country and abroad, an unexpected and urgent demand for oil tank vessels, which could only be met by the construction of a large number of additional ships. These conditions combined to create increased activity in shipbuilding, and it is reflected in the Society's operations for the year 1927–28. The new vessels classed by the Society during the year 1926–27 numbered 323, of a gross tonnage of 978,146 tons, whereas the corresponding figures for the year ended June 30th, 1928, were 578 vessels, of 1,885,533 tons gross, including no less than 77 yachts.

The increase in the volume of work in hand, however, was of short duration. The exceptional demand for new tonnage was more than met, and there is now a heavy

falling off in the number of vessels which have been ordered, and which are now in course of construction, the reduction being appreciably greater in Great Britain and Ireland than abroad. During the twelve months under review plans representing 476 vessels, of 1,454,050 tons gross, were approved by the Committee of Lloyd's Register. These figures are considerably below those for the preceding year, which were the highest reached since 1920.

It may be noted that of this projected tonnage 69·3 per cent.—1,007,340 tons—is intended to be built in Great Britain and Ireland, and 30·7 per cent.—446,710 tons—in other countries.

The number of vessels and tonnage for which plans were passed by the Committee during the year were 476 and 1,454,050 respectively. The countries in which the great majority of the new vessels, classed by Lloyd's Register during the year, were built are shown in Table I.

TABLE I.

Country.	No. of vessels.	Tons gross.
Great Britain and Ireland	418	1,348,004
Italy	21	153,413
Holland	24	73,788
Denmark	12	66,497
United States	22	63,877
Germany	40	53,819
France	9	41,770
Japan	7	31,885
Sweden	7	16,630
Spain	3	14,281
Russia	5	12,176

The total tonnage of merchant vessels afloat at the end of June, 1928, holding the classification of Lloyd's Register, amounted to 30,661,257 tons, and is the highest figure ever recorded in the history of the Society. Details of this total are as shown in Table II.

TABLE II.—*Vessels Classed in Lloyd's Register Book at June 30th, 1928.*

Material of construction.	Description.	Great Britain and Ireland. No.	Great Britain and Ireland. Gross tonnage.	British Dominions. No.	British Dominions. Gross tonnage.	Other countries. No.	Other countries. Gross tonnage.	Total. No.	Total. Gross tonnage.
Steel and Iron	Steam and motor	4,786	14,346,818	519	1,319,075	4,013	14,803,971	9,318	30,469,864
	Sail	137	38,771	35	13,408	108	113,415	280	165,594
Wood and composite	Steam, motor and sail	11	1,638	7	3,586	23	20,575	41	25,799
	Total	4,934	14,387,227	561	1,336,069	4,144	14,937,961	9,639	30,661,257

NOTE.—Sailing vessels fitted with auxiliary power are included in the figures shown for steamers and motor ships.

Moreover, at the end of the period under review, there were under construction throughout the world, to the Society's classification, 382 vessels, of 1,779,353 tons. The aggregate of shipping holding, or intended to hold, the classification of Lloyd's Register amounts, therefore, to 10,021 vessels, of nearly 32¼ million tons gross. Of the 1,779,353 tons referred to as being under construction at the end of June to the Society's classification, 1,047,270 tons were being built in Great Britain and Ireland, and it is noteworthy that the last-mentioned figure constituted over 87 per cent. of the total tonnage under construction at home.

During the year the following vessels, the tonnage of each of which exceeds 10,000 tons, have received the Society's classification :—

Vessel's name.	Tons.	Owners.
ms. "Augustus"	32,650	Navigazione Generale Italiana
ss. "Conte Grande (turb.)	25,661	Lloyd Sabaudo Soc. Anon. per Azioni
ms. "Saturnia"	23,940	"Cosulich" Soc. Triestina di Nav.
ss. "Duchess of Bedford" (turb.)	20,123	Canadian Pacific Railway Co.
ss. "Duchess of Atholl" (turb.)	20,119	Ditto ditto
ss. "Orford" (turb.)	19,941	Orient Steam Navigation Co., Ltd.
ms. "Bermuda"	19,086	Bermuda and West Indies S.S. Co., Ltd.
ss. "Malolo" (turb.)	17,232	Matson Navigation Co.
ms. "C. O. Stillman"	16,436	International Petroleum Co., Ltd.
ms. "Virgilio"	11,718	Navigazione Generale Italiana
ms. "Orazio"	11,669	Ditto ditto
ms "Victolite"	11,410	Imperial Oil, Ltd.
ms. "Vancolite"	11,404	Ditto
ms. "Cheshire"	10,560	Bibby Steam Ship Co., Ltd.
ss. "Albertville"	10,388	Cie. Belge Maritime du Congo
ms. "Gulfbird"	10,208	Gulf Refining Co., Inc.
ss. "Gretafield"	10,191	Northern Petroleum Tank S.S. Co., Ltd.
ss. "Harry Coulby"	10,180	Interlake Steamship Co.
ss. "Beaverford" (turb.)	10,042	Canadian Pacific Railway Co.
ss. "Beaverhill" (turb.)	10,041	Ditto ditto

(ss. = steamship ; ms. = motor ship.)

An interesting feature in the design of vessels dealt with during the period under review is the increase in the number of vessels built upon the Isherwood system of longitudinal framing. Since the end of June, 1927, 74 vessels, of 456,187 tons, had been constructed under the Society's superintendence. It may be mentioned that all these vessels, with the exception of one of 2694 tons, are intended for the carriage of oil in bulk. Included in the above are 17 vessels, of 126,688 tons, built upon the "Bracketless" system, a modification of the Isherwood longitudinal system of construction. In addition, 25 vessels, of 131,476 tons, were constructed upon the combined longitudinal and transverse system, and of those vessels, 19, of 85,138 tons, are also intended for carrying oil in bulk.

The total number of ships of all types of construction, intended for carrying oil in bulk—excluding those of less than 1000 tons—built under the Society's inspection during the twelve months under review, amounted to 102, of 587,491 tons gross. This tonnage considerably exceeds the corresponding figures for the preceding year, and actually forms more than 31 per cent. of the total tonnage classed during the period. In this connection it is worthy of note that, included in the above figures are those pertaining to the motor ship "C. O. Stillman," 16,436 tons gross, which, it is stated, is the largest tanker now afloat.

Among other types of vessels, classed by the Society since June, 1927, may be mentioned five vessels, aggregating 31,261 tons gross, for the American Lakes service, 1 train ferry, 77 yachts, 35 tugs, 23 trawlers and fishing vessels, and numerous river and harbour craft. Reference may also be made to the fact that a floating dock, for use at Barranquilla, Colombia, received the Society's classification, viz., "✠ Al Floating Dock."

Steam turbines were installed in 21 new vessels, of 209,018 tons gross, and in that figure is included 1 vessel—the steel sc. "Carl D. Bradley," 8806 tons—in which the turbo-electric drive is employed. With the exception of this case, all the turbines are associated with reduction gearing, in 17 of the vessels the single reduction type being employed, and in the remainder the double reduction type. Vessels to the number of 91, of 431,391 tons—or 40·6 per cent. of the total tonnage of new steamers that had been classed during the year—were fitted for burning oil fuel.

A development of exceptional interest in marine propulsion during the year under review was the use of pulverised coal as fuel for firing marine boilers. The Committee of Lloyd's Register has followed with close attention the experiments which have been in progress, and plans have been approved for the fitting of an installation which is capable of effecting the pulverisation of coal on board ship and its subsequent delivery in a finely powdered condition into the boiler furnaces.

An outstanding feature in the shipbuilding output for the year was the increased use of the internal combustion engine as a means of marine propulsion. New vessels fitted with this type of engine, to which classes were assigned by the Committee during the twelve months under review, numbered 160, of 812,437 tons gross, of which 150, of 811,983 tons, have engines using heavy oil. It is worthy of mention that, of the total number of vessels fitted with internal combustion engines, no less than 100, of 445,235 tons, have been built in Great Britain and Ireland. At the close of the period under review there were 685 motor ships, of 3,430,933 tons gross, recorded in Lloyd's Register Book, either actually holding the Society's classification or being completed under the special survey of the Society's Surveyors.

In the course of the year under review the Committee assigned classes to the following motor ships, each of which is over 9000 tons gross, viz.:—

Vessel's name.	Gross tons.
Steel quad.-screw "Augustus"	32,650
Steel twin-screw "Saturnia"	23,940
Steel quad.-screw "Bermuda"	19,086
Steel twin-screw "C. O. Stillman"	16,436
Steel twin-screw "Virgilio"	11,718
Steel twin-screw "Orazio"	11,669
Steel twin-screw "Victolite"	11,410
Steel twin-screw "Vancolite"	11,404
Steel twin-screw "Cheshire"	10,560
Steel screw "Gulfbird"	10,208
Steel twin-screw "El Argentino"	9,501
Steel twin-screw "Dunster Grange"	9,494
Steel twin-screw "Daghild"	9,272
Steel twin-screw "Sir Osborn Holmden"	9,153
Steel twin-screw "Christian"	9,119
Steel twin-screw "Athelmonarch"	9,031

Mention was made in last year's Report of the continued demand for double-acting Diesel engines. There are now being constructed, under the superintendence of the Society's Surveyors, 17 sets of this type, of approximately 180,000 indicated horse-power. The continued development in the use of internal combustion engines, as recorded in successive editions of Lloyd's Register Book, is clearly illustrated by the statistics in Table III., which include all motor ships of 100 tons and over :—

TABLE III.

Register book.	Motor ships (including auxiliary vessels). No.	Gross tons.
July, 1914	297	234,287
July, 1919	912	752,606
July, 1920	1,178	955,810
July, 1921	1,473	1,248,800
July, 1922	1,620	1,542,160
July, 1923	1,795	1,666,385
July, 1924	1,950	1,975,798
July, 1925	2,145	2,714,073
July, 1926	2,343	3,493,284
July, 1927	2,552	4,270,824
July, 1928	2,933	5,432,302

It is of interest to note that, of the 2933 motor vessels mentioned in the above table for the current year, 338 are of 6000 tons and upwards. Of them, 204 have tonnages ranging from 6000 to 7999 tons ; 95 are from 8000 to 9999 tons ; 25 are from 10,000 to 14,999 tons ; and 14 are of 15,000 tons and upwards.

Attention is drawn to the fact that the tonnage of vessels either employing oil as fuel for motors, or fitted with oil fuel burning installations, forms no less than 37·6 per cent. of the total tonnage of all existing vessels of 100 tons and upwards as recorded in Lloyd's Register Book.

The details are as given in the following table :—

	Tons gross.
Total steam and motor tonnage (including auxiliary vessels)	65,159,413
Types of engines—	
(i.) Steam reciprocating	50,045,048
(ii.) Steam turbines	9,682,063
(iii.) Motors	5,432,302
Fuel—	
(i.) Coal only	40,674,097 (62·4 per cent.)
(ii.) Oil (including steamers capable of burning either coal or oil)	24,485,316 (37·6 per cent.)

The combination of a low-pressure steam turbine connected to the main shafting of steam reciprocating engines through reduction gearing and hydraulic clutch, thus permitting the independent use of the reciprocating engines during manœuvring, provides an interesting development in the progress of marine engineering. During the year the Committee approved proposals for the construction of new machinery on this principle, and also for the conversion of existing steam reciprocating engines in a large number of vessels. The trials of vessels in commission thus fitted have proved entirely satisfactory, showing in each case increased efficiency and greater power than would have obtained had reciprocating engines only been in use.

Reference is made to an installation of the turbo-electric drive in the twin ss. "Viceroy of India," being built by A. Stephen and Sons, Ltd., for the Peninsular and Oriental Steam Navigation Company. The propelling machinery, apart from the main condensers and auxiliaries, is being made by the British Thomson-Houston Company, Ltd., and consists of two turbines driving two alternators supplying current to two motors, one on each shaft, the total shaft horse-power being 17,000. A further development in the Diesel-electric drive is evidenced by the oil tanker "Brunswick," 8947 tons, recently completed by Scotts' Shipbuilding and Engineering Company, Ltd., for the Atlantic Refining Company. The propelling machinery of this vessel consists of four Diesel engines driving four main electric generators supplying current to one double-unit main propelling motor. The main Diesel engines were made at the Usines Carels, of Ghent, and the electrical equipment by the British Thomson-Houston Company, Ltd. Another vessel, for which machinery of this type is under construction, is a ferry boat being built by Yarrow and Co. (1922), Ltd., for the Argentine Government. The two main Diesel engines in this case are being built by the Maschinenfabrik Augsburg-Nurnberg, A.-G., of Augsburg, and the electrical equipment by the Metropolitan-Vickers Electrical Company, Ltd.

During the year ended June last, refrigerating installations were fitted, under the special supervision of the Society's Surveyors, in 62 vessels, of an aggregate insulated capacity of nearly 5,500,000 cubic feet. Among the vessels fitted with installations of large capacity within the period referred to are the following :—

	Cubic feet.
ms. "Dunster Grange"	570,000
ms. "El Argentino"	570,000
ms. "Taranaki"	437,000
ms. "Zealandic"	416,020
ms. "Coptic"	416,020

In addition, 39 vessels are at present being fitted with refrigerating installations under the Society's superintendence. Since June, 1927, 3239 refrigerating machinery surveys have been held by the Society's Surveyors. As in previous years, the triennial surveys, required in connection with the Institute of London Underwriters' Approved List of Frozen Meat Stores, were carried out by the Society's Surveyors, and nearly 10,000,000 cubic feet of cold storage space has been inspected during the period.

The number of vessels to which freeboards were assigned by the Society, under the Merchant Shipping Act, 1894, in the course of the year, was 592. The chain cable tested during the year, under the Anchors and Chain Cables Act, 1899, at the eight public proving houses in this country, all of which are under the superintendence of the Committee of Lloyd's Register, amounted to 256,224 fathoms, weighing 19,415 tons. In addition, a quantity of miscellaneous chains and samples was also tested. The total number of anchors tested was 4690, with a gross weight of 6405 tons. At proving establishments abroad the Society's Surveyors have tested, during the same period, 67,033 fathoms of chain cable of 5220 tons weight, and 1813 anchors of 2803 tons. During the period ended June 30th, 1928, 1,075,872 tons of ship and boiler steel were tested by the Society's Surveyors at home and abroad. This figure is appreciably larger than that for the previous twelve months.

The respective quantities of ship and boiler steel dealt with between June, 1927, and July, 1928, were as follows :—

	Ship steel. Tons.	Boiler steel. Tons.	Total. Tons.
Home	653,548	41,938	695,486
Abroad	366,825	13,561	380,386
Total	1,020,373	55,499	1,075,872

At the present time there are 112 steel manufacturing firms in Great Britain and Ireland and 420 in other countries recognised by the Committee for the production of steel for use in the construction of ships and machinery intended for classification in Lloyd's Register Book.

THE Wickford and District Electricity Supply Company, Ltd., reports a considerable increase in the load on its undertaking. Since June this year the consumers have increased from 170 to 320, and further applications for supply have been received from over 100 more consumers. The maximum load has increased by over 100 per cent. as compared with the 1927 load. The overhead system has been changed from two-wire to three-wire, and completely reorganised by Callender's Cable and Construction Company, Ltd. A new 60-kW set has been put into commission and application has been made for sanction to install additional generating plant to meet the increased demand. The engineer recently appointed is Mr. W. O. Farrow.

Canadian Engineering News.

(From our own Correspondent.)

Considering only the actual turbines being installed in Canada this year, which will have a total capacity of about 550,000 horse-power, it is interesting to note that they will deliver more power than the entire installation of water wheels in the Dominion at the end of 1905. Canada's first half-million horse-power hydro-electric station was the Queenston plant on the Niagara River, which was built by the Ontario Hydro-electric Power Commission. This plant, the world's greatest individual installation, has a normal operating capacity of 525,000 horse-power. Five or ten years ago there were few people in Canada who could visualise some of the smaller streams in the Dominion rivalling the great Niagara cataract in the production of power. Yet this year the Ile-Maligne plant of the Duke-Price Power Company on the Saguenay River, in the province of Quebec, enters the half-million horse-power class with the installation of the eleventh unit of 45,000 horse-power. When the twelfth unit is installed the Ile-Maligne station will have a capacity of 540,000 horse-power. But that does not represent the ultimate achievement on the Saguenay River, for already the Alcoa Power Company, subsidiary of the Aluminium Company of Canada, is actively engaged on the construction of a station at Chute-à-Caron, which will ultimately develop 800,000 horse-power.

At the opposite end of Canada, work has begun on the driving of a 2¼-mile tunnel which will deliver the waters of Bridge River, British Columbia, to a power station at Seton Lake, where the British Columbia Electric Railway Company will deliver 500,000 horse-power. These four great stations will deliver an amount of power equivalent to the entire developed water power in Canada in 1918.

There are also other achievements in the same class, notably the developments of the St. Maurice and the Gatineau rivers. On the St. Maurice the plants concentrated in a distance of 12 miles and principally owned or controlled by the Shawinigan Water and Power Company, now have an installed capacity of 557,000 horse-power, and before this year is ended the amount will be 600,000 horse-power. On the Gatineau River the Gatineau Power Company's three interconnected plants will be brought up to 436,000 horse-power this year, while the planned capacity is 562,000 horse-power.

The Winnipeg River, in the province of Manitoba, is also another of Canada's most wonderful power streams, where installation by the end of this year will exceed 300,000 horse-power, and other large installations are in prospect.

Among the more important power development projects now under way in Eastern Canada is that of the Ontario Paper Company, Ltd., on the Outardes River, in the province of Quebec, about 190 miles below the city of Quebec. There, in the heart of the province's least-known territory, men have planned for the turning of the wealth of the forest into newsprint, and for this purpose have started to harness the natural falls of the Outardes. An auxiliary power-house has been erected to provide light and power for the works, and for the permanent quarters of the company's officials.

Where the little hamlet of Outardes Falls now stands the power station, designed for an ultimate development of 300,000 horse-power, will be built. The station will be fed from the stored waters of the barrage some 3 miles distant. The waters will be carried down for about three-quarters of a mile through an open canal, and thereafter for the remainder of the distance through a 16ft. penstock.

The barrage, which will be 230ft. long, will have a net head of 205ft. and will serve an initial development of 40,000 horse-power. This barring of the river at its swiftest point will back the water up to flood an area of some 1000 acres. The main barrage will span the river, while two smaller barrages will deal with two natural depressions in the ground, which will become watercourses when the work is completed and will be controlled by sluice gates.

The hydro-electric power developed at Outardes Falls will not be used there, but will be carried by transmission line across the neck of the Manicouagan peninsula for more than 25 miles to the site on English Bay chosen by the Ontario Power Company for its new mill. The company has already spent 1,000,000 dollars in the Outardes area and expects to spend a total of seven million dollars.

CONTRACTS.

The Westinghouse Brake and Saxby Signal Company, Ltd., has received an order for 500 sets of "Prestall" wrought steel vacuum brake cylinders and fittings for steel bogie wagons now being built for the Cordoba Central Railway by the Birmingham Railway Carriage and Wagon Company, Ltd.

The Brown-Boveri organisation has received an order for a three-cylinder single-shaft turbo-generator, for an output of 36,000 kW at 3000 r.p.m., required by N.V. Provinciale Noordbrabant'sche Electriciteits Maatschappij (Holland), for the Geertruidenberg power station. The plant will consist of the turbine with a three-phase alternator generating at 12,000 volts and for a power factor of 0·8, surface condensing plant, distillation and pre-heating plant. The steam pressure will be about 450 lb. per square inch gauge at about 750 deg. Fah.

Messrs. Clark and Standfield, of 11, Victoria-street, S.W.1, have received an order from Aktieselskabet Framnaes mek Vaerksted, of Framnes, near Sandefjord, for a 10,000-ton floating dock of the sectional box type. It will have an overall length of 532ft. 9in., with an overall breadth of 106ft., and the clear width of entrance will be 82ft., and the draught over the keel blocks 20ft. Messrs. Clark and Standfield informs us that this dock will be the one hundredth constructed to their designs, and that the aggregate lifting power of the hundred docks totals 825,000 tons, which constitutes an interesting record.

Mirrlees, Bickerton and Day, Ltd., of Hazel-grove, near Stockport, and Westminster, have received the following orders:—(*a*) For a six-cylinder 450 B.H.P. "Mirrlees-Diesel" oil engine coupled to a dynamo of the Electric Construction Company's make, for the Barnstaple Electricity Works; (*b*) for two six-cylinder 450 B.H.P. "Mirrlees-Diesel" engines coupled to G.E.C. generators for installation at Port Sudan, from the Sudan Government; and (*c*) for a six-cylinder 300 B.H.P. "Mirrlees-Diesel" engine, to a generator ordered from the Electric Construction Company, from the Windermere and District Electricity Supply Company.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Brisker Business.

Brisker buying in nearly all departments of the Midland iron and steel trade is reported this week. Fears are entertained that both steel and raw iron prices may advance in the near future, and firms which have good order books are in some cases covering themselves, as regard material supplies, for some time ahead. Not only so, but the general trend of trade seems to be encouraging a more optimistic outlook. Some large manufacturers in this area are of opinion that the recent improvement in business is something more than one of those fitful spurts such as have been experienced on several occasions during recent years, and that it is likely to be maintained. A gradual expansion of activity is taking place at certain Midland works, and though the progress is slow in the various branches of engineering, it is none the less evident. While the iron and steel industry is not, as yet, making a sufficient turnover to enable large economies to be effected in production costs, it is doing better than it was a few months ago. The comparatively high price of continental materials and the length of time which is required for delivery, give native iron and steelmasters a better chance of securing business than they have had for a considerable time. The market tone then is bright, and prospects, even if they cannot be considered really good, are a great deal better than they were.

Raw Iron.

Pig iron consumption is swelling, and the remaining stocks at furnaces are visibly diminishing. Users are seriously contemplating placing forward contracts, especially as in many instances blast-furnacemen are now endeavouring to get higher prices for their output. It is reported this week that quite an appreciable amount of this class of business has been done since the quarterly meeting a fortnight ago, and at prices better than those which have ruled until recently, but hardly so high as those now quoted. Some movement in the direction of increasing output is reported. The Derbyshire furnace which, as already stated, is being brought back into service, is expected to be in operation next week, and a rumour is current that a furnace is to be restarted shortly at Lilleshall, Salop. Smelters, generally, however, will want to get a firmer grip on the market than they have yet secured before they think of increasing their productive capacity. Pig iron prices continue firm. Northamptonshire makers quote £2 16s. for foundry iron, although there is an exception in one case where £2 18s. is charged for iron from stock, the furnace in this case being idle. Derbyshire makers adhere strictly to the £3 minimum, most of them asking £3 1s. The North Staffordshire price stands at £3 2s. 6d. Midland smelters are still competing in the East Coast market with some success.

Steel.

The improved demand for steel is upheld, and makers report better sales of both finished material and half-products. A little more consistency in buying would, however, be appreciated. Structural engineers have a wide range of orders which in the aggregate call for a fairly heavy tonnage. The mills nevertheless require substantial orders to keep their machinery in regular employment. For billets and small bars there is a good demand, and motor car engineering firms are now calling for large supplies of special steel products, and negotiations are being opened in other directions. In the uncertain poise of the raw material market re-rollers are not disposed to commit themselves too far in advance. Many steelmasters think the time is ripe to put prices on a more remunerative level, and the question of price readjustment is said to be under consideration by the Association. It is to be hoped that steelmasters will realise that, whatever measures are taken with this object, regard must be had to the effect of increased prices on consuming branches in which the improvement in trade has not yet made much headway. The shipbuilding industry is a very important factor in this matter, and it is reported to be out of consideration for that trade that steelmasters have, so far, postponed any increase in the price of steel. The position is being carefully considered, and a keen watch is being kept by consumers for developments. The British trade is benefiting by the scarcity of foreign billets, which are still very difficult to obtain from Belgium. The shortage now extends to blooms, and prices quoted are such as to strengthen the ascendancy of native steel. Slight decreases have taken place in continental steel during the week, ¼in. sheets having fallen from £6 11s. to £6 10s., and steel bars to £6 1s., f.o.b. British billets now cost from £6 8s. 6d. to £6 10s., a rise of a few shillings during the last week or two. With the rise that has already taken place in raw materials, wire rods have stiffened to £8 12s. 6d., which is about 5s. above the continental price. The demand for heavy steel scrap continues good, and sellers have no difficulty in doing business at £3 10s. delivered South Wales.

Staffordshire Bars.

In the Staffordshire iron trade there is a fair demand for marked bars, the basis for which remains at £12, but for other classes of iron inquiry is very poor. Crown quality bars of Staffordshire make, quoted round about £10, do not sell in competition with others offered at as low as £9 2s. 6d. Local makers contend they cannot sell at a lower figure without producing bars inferior to those at present being turned out from district mills. Cable and anchor makers are calling for but small tonnages of material, their works being far from well employed. Nut and bolt bars made in Staffordshire and offered at £8 12s. 6d. to £8 17s. 6d. find few purchasers. Belgian No. 3 iron can be bought at £7 7s. 6d. delivered, a price more attractive to Black Country bolt and nut manufacturers. Fortunately the tube trade has been active, and large quantities of iron gas strip have changed hands. The demand remains good, and one concern making best iron strip has been able to operate at about 70 per cent. capacity during the last twelve months. The motor industry is calling for a good deal of cold rolled sheets and strip in connection with engine parts.

Galvanised Sheets.

A firm tone is maintained in the galvanised sheet trade, where overseas business continues to expand. Though exports to India last month were much below those in the previous month, a revival of buying from that market encourages the hope of a recovery in shipments this month. Many local mills quote £13 15s. for 24-gauge corrugated sheets, but others not so well booked are prepared to sell at £13 10s. The number of the latter is, however, gradually becoming smaller. Lighter gauge sheets are in good demand, and the call for black sheets is gaining weight.

Midlands Centre I.E.E.

At the first general meeting of the session of the South Midlands Centre of the Institution of Electrical Engineers recently held in Birmingham, the chairman, Mr. S. H. Holden, took as the subject of his opening address, "Electricity Meters, Measurements and Standardisation." The session promises to be of more than usual interest as, in addition to an excellent programme of papers, there will be a cinematograph exhibition arranged by the Institution in co-operation with the Institution of Civil Engineers and the Institution of Mechanical Engineers.

Razor Blades for the Army.

As I write the report comes to hand that the firm of Messrs. Myatts, Birmingham, has just secured the War Office contract for the supply of safety-razor blades to the British Army. Its tender was accepted in competition with American and other foreign firms, and was the lowest out of many offers. It will be remembered that in 1926 dissatisfaction was expressed in Parliament that a similar order had been given to an American firm.

Unemployment.

The total of unemployed persons in the Midlands area is lower by 2063 than that given in my last report. The steady decline during the past few weeks in this area is very satisfactory, and many industrialists hereabouts express considerable optimism as to the prospects for the coming winter. There is, however, plenty of room for improvement at the moment, especially in the iron and steel and metal-working industries. Employment is better than it was, however, in the motor engineering, edge tool and tube trades of the district. The workless in the area at date total 179,421.

LANCASHIRE.

(From our own Correspondents.)

Manchester.

Site for Air Port.

Events seem now to be moving rapidly towards a solution of the problem of selecting a site for the proposed aerodrome to be established in Manchester. Quite recently it was believed that the ultimate choice would be the Wythenshawe estate, but within the last few days there has been a somewhat surprising development, and it is regarded as reasonably certain that the aerodrome will be constructed on a site at Barton Moss, for which a number of advantages are claimed. In the first place, the land is already the property of the Manchester Corporation, and the cost of carrying out the necessary alterations to render it suitable for the purposes of an air port will be relatively small compared with the expenditure that would have been entailed in connection with the Wythenshawe site. Moreover, Barton Moss is situated in country which, from its flat and open nature, is eminently suitable for the purpose in view, and, in addition, is no more than about 7 miles from the centre of the city, with prominent landing marks in the shape of the Manchester Ship Canal and the railway line. Air Vice-Marshal Sir Sefton Brancker, Comptroller of Civil Aviation, carried out an official inspection of the site during the past few days, and expressed a very favourable opinion regarding it. Sir Sefton, incidentally, said the Government might find it necessary to erect and maintain a wireless and meteorological station in the North of England, and that if Manchester had an aerodrome ready it might be established there.

Waterless Gasholders.

The members of the Manchester District Institution of Gas Engineers, on the occasion of their quarterly meeting, paid a visit of inspection to the engineering works of R. and J. Dempster, Ltd., Miles Platting, Manchester, to study the plant which the firm has installed for the purpose of manufacturing the new waterless gasholders. The Manchester installation is the only one of its kind in this country and one of the three in existence, the other two being in Germany and the United States.

The Civil Engineer.

In the course of his opening address as Chairman of the Manchester and District Association of the Institution of Civil Engineers, Mr. S. H. Morgan said the inexperienced and untrained were permitted by law to call themselves engineers, and even civil engineers, and to undertake the construction of works or buildings upon the safety of which the lives of many people might depend. Up to the present the public had been slow to recognise this fact, and to protect themselves, but Mr. Morgan expressed the view that the time was not far distant when the question would receive adequate attention. Mr. A. C. Dean, who has retired from the hon. secretaryship of the Manchester Association, has been presented with an

illuminated address signed by all the past-chairmen of the Association.

Damming the Ribble.

Preston Town Council, through its Finance Committee, has decided to introduce a Bill in Parliament during the coming session with the object of securing powers to dam the river Ribble, at an estimated cost of £75,000, in order that an adequate supply of water may be obtained for the power station, which, under the central electricity scheme, is to undergo a process of development on a very important scale.

Lancashire Road Programme.

A scheme of the Lancashire Main Roads Committee for improving the roads to Blackpool was outlined by Alderman Aspell, the chairman of that body, on the occasion of the official opening on Monday of this week of a new by-pass road for traffic from Preston and Blackpool to the North, which cuts out Garstang. This road is 60ft. wide and has cost nearly £100,000 to construct. The Roads Committee's scheme relating to the Blackpool routes will entail an aggregate expenditure of about £500,000, and will take about three years to complete.

Cork to Manchester.

Shipments of machinery from the Ford works at Cork to the Manchester works of the firm continue, about 300 tons having left Ireland on Friday of last week by the steamship "Inniscarra." A further cargo was expected to be shipped this week.

Non-ferrous Metals.

Firmness has been in evidence in virtually all sections of the non-ferrous metals markets during the past week. Copper has been especially notable in this respect, and prices on balance are appreciably higher than those current a week ago. There has been a moderately active turnover in standard brands of this metal. Refined descriptions have not been particularly active, although a number of orders have been reported on account of the cable-manufacturing industry. Statistical indications at the moment seem to be in favour of continued firmness in this section of the market. Tin prices during the past week have touched the highest point reached since the latest upward movement set in in the early part of last month, values at the moment of writing being in the neighbourhood of £5 a ton above those current a week ago. A fair quantity of the metal is going into consumption, and speculative operations have been more prominent of late. Buying interest in the case of lead has shown a tendency to expand, and after a series of minor fluctuations prices have finished up pretty well where they were a week ago. Spelter also seems to have attracted a little more attention, and this has been reflected in a slight improvement in values after a somewhat prolonged period of easiness.

Iron and Steel.

The market for foundry iron locally has been subject to rather quiet conditions this week, and the tonnage booked has been smaller than it was a fortnight ago, before the advance in Staffordshire and Derbyshire brands came into operation. Here and there are reports of offers at about the former range of prices, but most of the leading producers have come into line, and are quoting at the higher rates, whilst other varieties of iron are firm and show little change on the week. For delivery to local works, Staffordshire No. 3 is quoted at about 67s. 6d. per ton, Derbyshire at 68s., Middlesbrough at 79s., Scottish at 87s. 6d., and West Coast hematite iron at 81s. 6d. to 82s. In spite of a very moderate demand for bar iron, prices keep steady at £10 per ton for Lancashire Crown quality and £9 10s. for seconds. Apart from a few contract commitments which consumers are entering into to cover contracts in hand, practically the whole of the buying in the steel market is for prompt or early rollings, with constructional engineers the chief buyers. No important orders for boiler plates, either for locomotive builders or for boilermakers, have been reported this week, but there is still a fair volume of business passing in steel bars. For sections, current values are at £7 17s. 6d. per ton, with basic boiler plates at about £9 10s. and acid qualities at a premium of 5s., general plates at £8 12s. 6d., large bars at £8 17s. 6d., and small re-rolled sorts at £7 17s. 6d. to £8. As before, the demand for foreign steel materials is on a strictly limited scale, but quotations in this section, except for occasional concessions in bars, are firmly maintained at late rates.

BARROW-IN-FURNESS.

Hematite.

The position in the hematite pig iron market remains about the same. There has been no further increase in business, but the better conditions which developed a month or two ago are maintained. Makers are now clearing their output and are also in a position to get rid of some of their stocks, which up to a few months ago had been accumulating. The steel departments at Barrow and Workington are taking a fair quantity of iron, and this is naturally a factor in the reduction of stocks. There is a tendency on the part of buyers to place orders for forward delivery, and this fact encourages the idea that the present state of trade is likely to continue. Certainly there is more confidence in the market. Sales of pig iron are mostly on home account, and there is not much going abroad. Special qualities are in fair demand. Business in local ore remains about the same, with a slightly better prospect as regards outside orders in view of more activity in Scotland and elsewhere. In the steel trade there is very keen competition, and such orders as are available are only obtainable at very low prices. There have been a number of inquiries for rails, but prices have to be very low to tempt buyers. The mills at Barrow and Workington are engaged upon railway material, but are not assured of a long run unless fresh orders are forthcoming. The hoop and small section mills at Barrow are kept employed, and the outlook is fairly assured.

SHEFFIELD.

(From our own Correspondent.)

The Heavy Steel Trade.

The improvement in the demand for basic steel is maintained. Foreign competition in this class of material has fallen off to a marked extent, and, while not entirely eliminated, is not a serious factor at present. Continental firms show no anxiety to sell, and they are asking prices which, for some of the materials, shut them out of the British market. As British firms are not seizing the opportunity to increase their prices, consumers have no inducement to send abroad for their supplies. The situation is benefiting Sheffield, and is proving of still more advantage to the Lincolnshire district, where the product consists chiefly of the softer basic steels. The works in that area are now enjoying a fair measure of activity, and there is much less unemployment than in other centres. On the acid side of the heavy steel trade, however, there is no recovery to report, the reduction in the price of billets not yet having had any appreciable effect on the situation.

A Review of Departments.

There is not much likelihood of an improvement in the better quality steels until the home railway companies come into the market for larger supplies. They have been pursuing a policy of great economy for a longer period than was expected, and there are now fears that a return to normal specifications may be postponed until the New Year. The position at some of the railway plants has been relieved during the past week by the placing of fairly substantial orders from South Africa and South America for axles, tires, and other steel material. As a result, certain firms have been enabled to resume full-time working. This will not last long, however, unless further orders come to hand. Some of the local engineering firms have a moderate amount of work in progress, and there is a good sale for special lines of steel forgings and castings. The automobile trade is still one of Sheffield's most important customers, and although its demands have shown a falling off lately, a recovery is expected as a result of the motor exhibition. Requirements for shipbuilding and general engineering are moderate. An improvement is to be noted in the demand for wire rope and the wire used in its manufacture. The requirements of the mining industry are not up to the average, but in other respects there has been a good demand for wire rope and cable throughout the year.

The United Steel Companies.

Some interesting facts were mentioned by Mr. W. Benton Jones, the chairman, at the annual meeting of the United Steel Companies on Monday. The combine forms an exceptionally large coal, iron and steel undertaking, with mines and works in three separate areas of the country. Its production of steel during the year ended June last was one-tenth of the production of the whole of the United Kingdom. It amounted to 850,000 tons, but this was only about two-thirds of the companies' full capacity, which is 1,250,000 tons. The output of coal was 2¼ million tons, out of a full capacity of 3 millions. The total number of men employed was 26,500, as against 30,500 required when working at full capacity. The fall in prices had a very serious effect on the financial results of the year. "The depression in the heavy trades," said Mr. Jones, "has continued throughout the year, and, while its severity has been greatest in the coal trade, the prices obtainable for iron and steel have also shown a further decline. In our own case coal prices have fallen by 2s. per ton, and the fall in steel prices varies between 5s. and 10s. per ton, according to the class of product." Taking the figures of production already mentioned, Mr. Jones showed that the reduction in prices represented a fall in value of more than £600,000 as compared with the prices ruling at the end of the previous year. To meet this reduction, there had been no relief of any kind, but the companies had still succeeded in making a net profit of £123,761. Mr. Jones also pointed out that the companies' works at Frodingham were able to produce, and actually were producing, 50 per cent. more than in pre-war days, while at Appleby the recently completed extensions formed one of the most modern and efficient steel plate works in existence. He added that, in the continued state of depression in the heavy trades, he would not be expected to prophesy a rapid advance to prosperity, however confident he might be, but they looked forward to a gradual and progressive improvement.

A Busy Buffer Works.

The annual report of George Turton, Platts and Co., Ltd., steel and buffer makers, shows a net profit of £11,802, as compared with £20,417 in the previous year and the dividend is 7½ per cent., as against 8¾. A new spring shop is at present under construction at the firm's Meadow Hall works, Sheffield, and when this is completed considerable economies in manufacture are anticipated. The existing spring shop at Furnival-road will be added to the drop stamping department, and additional stamping and forging plant installed. The company is fairly well provided with orders. Some of the departments are working night and day, and the prospects for the current year appear to be encouraging.

Cutlery and Plate.

The busiest period of the year in the cutlery and plate trades has now been reached, and there is consequently a great increase of activity on recent months, but reports indicate that the position is not at all satisfactory. In the case of many firms the bookings are poor, and there has been little business from Australia during the past week or two. It is feared that the Christmas season trade will not be up to the average. The demand for cutlery material is not up to that of October last year, but is in excess of August and September. The New Year will see the deferred clauses of the new grinding regulations come into operation, which means that either the old-time sandstones must be replaced by artificial wheels or else extensive structural alterations must be carried out at the older grinding hulls. In many cases the substitution has already been carried out, and the modern grinding medium is giving satisfactory results, but the cost is high, which makes matters awkward for outworkers, who provide their own wheels, and for the "little mesters." Some of the artificial stones are being supplied on the instalment plan, and employers are coming to the assistance of their men.

The Future of Gainsborough.

Bright hopes are entertained for the industrial future of Gainsborough as a result of the improvements of the river Trent, which have been carried out at huge cost by the Corporation of Nottingham. The Corporation has constructed locks and deepened the river, and built docks at Nottingham, with the object of making the city an inland port with natural water communication to the Humber. The Trent Navigation Company, realising the exceptional opportunities which have arisen for the development of water-borne traffic, has decided to establish a depôt at Gainsborough. Wharfage has been secured, and the preparations for the receipt and distribution of all kinds of goods have passed the initial stage. A daily barge service between the Humber ports and Gainsborough, Newark, Nottingham, Leicester and other places is being run. It is hoped that before long a service for a larger type of vessel, propelled by its own power and working between the near continental ports and Gainsborough, will be established. From these vessels the cargo will be transhipped into ordinary barges, and when necessary to warehouses and road vehicles. Mr. S. F. Bagshaw, the general manager of the Trent Navigation Company, has expressed very optimistic views regarding the development of the Trent and its beneficial influence on Gainsborough. He said it should certainly attract to the town manufacturers who were desirous of opening new works. Situated practically on the coalfield and also in the important ironstone area, and with exceptional transport facilities, Gainsborough, as regarded water-borne trade, should take its place among the principal industrial centres of the country.

£100,000 Pier for Hull.

A proposal to construct a new floating pier, which will rise and fall with the tide, has been approved by the Hull Corporation Bridges Committee, and the necessary parliamentary powers are to be sought. It is intended to renew and improve the present pier, and to connect it with the new landing stage by a bridge, 28ft. wide and 200ft. long. The landing-stage, which will cost £100,000, will be 380ft. long and 60ft. wide. It is proposed to levy ferry tolls on passengers, cattle, horses, and vehicles, and it is estimated that a 1d. toll on passengers will alone yield £1000 per year. While on the subject of East Riding industry, mention may be made of the fact that two steel screw trawlers were launched last week at the Ouse Shipbuilding Yard of Cochrane and Sons, Ltd., Selby, for Consolidated Fisheries, Ltd., of Grimsby, Swansea, and Lowestoft. They are for the port of Swansea, and will engage in the West Coast fishing industry. Each of the vessels measures 130ft. between perpendiculars by 24ft. by 13ft. 9in. moulded.

Hope of Pit Reopening.

The Prince of Wales Colliery, Pontefract, which was closed a month ago, is likely to be reopened shortly under new proprietorship. Pontefract Town Council, which owns 365 acres of land under which the pit mainly operates, has empowered a committee to complete negotiations for a new lease to prospective purchasers of the undertaking. The name of the new proprietor has not been disclosed, but it is understood to be the Glass Houghton Collieries Company, Ltd., whose workings extend almost to the Pontefract coalfields boundary. The Council also instructed its Gas Committee to consider the possibility of accepting a supply of coke oven gas from the Yorkshire Coking and Chemical Company, Ltd., an ally of the Glass Houghton Colliery, with works adjoining.

NORTH OF ENGLAND.

(From our own Correspondent.)

Cleveland Iron Trade.

There has been no development of any consequence in the Cleveland pig iron trade this week, but steady conditions and regular, if small, sales continue to prevail, and the outlook is not unsatisfactory. Some expansion of market operations in the very near future is confidently expected, as customers have yet to make provision for a good deal of their autumn needs. Disinclination of buyers to commit themselves at all extensively ahead is attributed to the feeling that quotations are likely to keep about ruling rates for some time. The limited output of Cleveland iron continues to go chiefly into direct use at producers' consuming plant, and the surplus quantity is absorbed by current market requirements. Stocks are not heavy, and it is more than probable that production will be increased shortly by the rekindling of one or two idle blast-furnaces. Prices are firmly maintained, No. 1 Cleveland foundry iron being 68s. 6d.; No. 3 G.M.B., 66s.; No. 4 foundry, 65s.; and No. 4 forge, 64s. 6d.

Hematite Pig Iron.

Values of East Coast hematite pig iron show a marked upward tendency consequent upon increased demand and shortage of iron, and some producers are now declining to enter into contracts on the terms obtainable. In this branch quotations are a matter of individual bargaining, makers having no arrangements as to fixed figures. Home and continental consumers are buying steadily, and the restricted output is inadequate to requirements. A few substantial sales to South Wales and also to Italy are reported. For ordinary qualities 70s. is freely offered, and rather more is stated to have been obtained.

Ironmaking Materials.

There is no new feature in the foreign ore trade. Quotations are firm, but consumers are not disposed to

discuss business. Imports against old contracts are fairly good, but merchants continue to assert that there will be a shortage of supply next year. Market rates are based on best Rubio at 22s. 6d. Consumers of blast-furnace coke continue to buy sparingly in the belief that supply will be very ample in a month or two hence. Good average kinds are round about 17s. 9d. delivered at North-East Coast works.

Manufactured Iron and Steel.

Business in the manufactured iron and steel trade is improving, and there is a hopeful spirit abroad regarding the outlook. Continental prices for several descriptions of material have advanced, and that fact has virtually stopped the purchase of foreign semi-finished steel by local consumers, who now find it more profitable to buy their supplies in the immediate district. Producers of certain steel commodities have a lot of work in hand, but manufacturers of one or two descriptions of material need orders. The galvanised sheet trade is very busy, orders in hand ensuring active conditions at the works for some months ahead. Prices are steady and unchanged.

The Coal Trade.

Much larger outputs are now the rule in the Northern coal trade, and prospects for increased business are more encouraging. Northumberland steam coals of the large size continue in a very satisfactory position. There are large bookings well into November, and any prompt lots offering command late prices. The collieries that are working are experiencing no idle days at the moment, and thus the demand is balancing supplies very equably at present. Best steams are quoted 13s. 9d. to 14s., and seconds at 12s. 9d. to 13s. 3d. Of smalls it is not possible to indicate so favourable a state of things. They are much more abundant than the market can absorb, and this militates against what otherwise would be a very comfortable situation. All the same, there is every reason to be grateful for the larger volume of business that has come to large steams since the end of September. Durham large steams are likewise firm, and the smalls in that county are quietly steady. For Durham gas and coking unscreened the demand shows some slight expansion, but although prices are quoted steadier, buyers can still cover at reasonably low values. Best gas coals are 14s. 9d. to 15s., and seconds 13s. 3d. to 13s. 6d. The coke trade is nominally firm, but the pressure for supplies is not so keen as recently. Gas coke makers, however, are heavily sold and well supplied with stemmed tonnage for two or three weeks ahead, and prices, whilst irregular, are holding fairly steady at 20s. to 20s. 6d. Patent oven cokes are in ample supply for next month, but prices are steady at 18s. 3d. to 19s. for ordinary, and 24s. to 28s. for special and beehive qualities.

Important Contract for the Tyne.

Swan, Hunter, and Wigham Richardson, Ltd., Wallsend-on-Tyne, have booked an important contract for a large whaling depôt vessel. It will be one of 15,000 tons, and will be equipped with special plant, including blubber boilers, cutting-up machines, and apparatus for lifting whales to the deck. The contract price is stated to be about £275,000.

More Northern Coal for London.

The possibility of a greater demand in the North of England coal trade from the London area for household coal, as a result of the Midlands area having put up inland prices, has been eagerly discussed in coal trade circles this week. This autumn there have been larger sales than usual of Northumberland and Durham coal to the Thames and South Coast, and these orders have been carried both by land and sea. It appears that London merchants are not getting on very well just now with their supplies from the Midland counties concerned in the Yorkshire "five counties scheme." The quota of the collieries is evidently too low, and this has tended to increase the price. The general opinion among Northern coalowners is, however, that though they are eager for more business, the chances of increasing the London trade to any substantial extent are not great. It is thought that in the face of threatened competition the "five counties scheme" quota would be increased sufficiently to satisfy the London merchants. Further, freights from North-East Coast ports are firm, and largely increased consignments, it is feared, would send up the freight charges to such an extent that the position of the Midland collieries would be secure. In the meantime, however, the North is ready to do more business.

SCOTLAND.

(From our own Correspondent.)

Shipbuilding Order.

It is announced that Lithgows Ltd., Port-Glasgow, have secured an order for five cargo steamers from Mr. B. Pardoe-Thomas, Newport, Mon. Three of these vessels will be of 6400 tons each and two of 7200 tons each.

Steel and Iron.

The position in the steel and iron trades shows little change on the week. The general demand is not improving, and some producers experience difficulty in keeping plants engaged. Heavy steel is in very quiet demand, especially in respect to shipbuilding materials. Fair orders for structural steel are reported, but producers could easily undertake additional business. Steel sheet makers have a good demand for light gauges, but heavy descriptions are dull. Galvanised flat and corrugated sheets have a good export market at present, and quotations are firm round about £13 10s. to £13 15s. per ton. Bar iron is dull, and the re-rolled steel department, though fairly busy, is not so well placed owing to dearer costs of raw materials. There is a better demand for hoops and strips of local production in view of higher costs and protracted deliveries of continental material. There is very little movement in pig iron, and the output from the small number of furnaces engaged is ample to meet all demands. Quotations on the whole are unchanged.

Exports and Imports.

During the past week imports at Glasgow Harbour included 10,000 tons of iron ore and 1700 tons of iron and steel. Exports included 3200 tons of steel and iron and 694 tons of pig iron.

Coal.

The coal market remains practically unchanged. Home demands continue light, and the export turnover is far below expectations. Consequently, with increased outputs, the collieries find considerable difficulty in securing the advanced prices recently quoted. Lanarkshire ells are very scarce and firm, and splints a shade steadier than in recent weeks. Fifeshire third-class steams are heavily sold and are now almost unobtainable for prompt shipment. First-class Fifeshire have improved their position somewhat. Lothians steams are quiet but steady. Washed nuts are irregular. Trebles are firm in all districts and especially so in Fifeshire, but smaller sizes show weakness. Aggregate shipments amounted to 238,386 tons, against 262,759 tons in the preceding week and 268,600 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

Outside of the coal trade, there is not much in the industrial conditions which claims one's attention on account of any change. Ship-repairing is quiet, and the same can be said of the iron and steel trades, but in the case of coal it is at last possible to see indications of a slight improvement. This does not apply to the immediate position, for the reason that tonnage is so short in supply that many collieries are very badly off for a ready outlet for their coals. This is shown by the fact that at the end of last week there were over forty idle tipping appliances at the various docks in this district, and this week was started with the number standing at twenty-nine. Exporters and coalowners were naturally disappointed, but at the same time it was not surprising, inasmuch as the volume of chartering of late has fallen below the 300,000-ton mark. Even though exporters have conceded higher rates of freight, that step has not so far attracted much additional tonnage to this market, though hopes are entertained that next month will show an expansion in the amount of tonnage being offered for employment from South Wales ports. Still, shipments last week were in advance of those for the previous week, the figures being 418,142 tons, as against 395,962 tons, and it is quite likely that the returns for the whole of this month will be more satisfactory than they were for September, which was a bad month. There are, however, one or two features which give one hope, and indeed afford evidence that the conditions in the coal trade are likely to be better before very long. For one thing, a few collieries are now full up with orders for the remainder of this month, and last week the minimum price for three coals of the Admiralty quality was advanced from 18s. 6d. to 18s. 9d. The effect of that will be, of course, that other coals which were in the same grade will come in for more request. There is also evidence that more business is in hand from the number of orders being quoted for on the freight market, and there is little or no doubt that more business has been closed in the past few weeks than was expected. The report is current that one of the collieries producing Admiralty coals has already done business over next year at 18s. 6d., and that will perhaps stimulate other buyers to come along and operate. It is, of course, disappointing to hear that the Paris-Orleans Railway, which has purchased some of its requirements from South Wales, has also bought 150,000 tons of large coal from Germany for delivery over 1929, but other railway business for Spain and for South America has been done for South Wales coals to be delivered over the remainder of this year and over part of next year, while tenders have gone in this week for over 200,000 tons of fuel and 30,000 tons of washed smalls for account of the Algerian State Railways, to be supplied over a period of about fourteen months from November, and also for about 200,000 tons of superior Admiralty coals for the Brazilian Central Railways for delivery over about four months.

Coal Inquiries.

The Argentine Central Railways are now in the market for 500,000 tons of best Welsh large coal for delivery over next year. This business is quoted for on an f.o.b. basis. It is also reported that the Paris-Orleans Railway will be shortly asking for prices for 30,000 tons of smalls in three lots of 10,000 tons to be delivered this year, and for 120,000 tons in four lots of 30,000 tons each for shipment over the whole of 1929.

Dock Pilots.

The system by which dock pilots at Barry are engaged, according to a rota, came to an end last week, and on Monday the new system of individual employment became operative. This change has been instituted by the shipowners, but not without the opposition of some of the men. It was at one time reported that the dock pilots and boatmen intended striking against the alteration, but boats came in during the early part of this week with dock pilots appointed by the owners without any trouble. It appears that there are about a dozen pilots who are opposed to the change, and they have the support of a number of the boatmen, but their opposition is not regarded as very serious.

Steelwork Order.

Satisfaction is felt in this district that Braithwaite and Co., Ltd., of Westminster, who own the Neptune Works at Newport, have secured an order for the supply of all the steel transmission line towers required for Part I. of the South-Eastern electricity scheme. These towers, which represent more than 5000 tons of structural steelwork, are to be manufactured by mass production methods at the company's branch works at Newport. Arrangements have been made to obtain an output of 300 tons per week of finished tower material.

Current Business.

There is a better forward inquiry for steam coals, but the majority of collieries are handicapped so far as their immediate position is concerned by the shortage of prompt tonnage. The docks are not at all well off in this respect, and the result is that standing stocks of coals are heavy. A number of the leading undertakings are quite well off from the point of view of orders on their books, but exporters are experiencing difficulty in getting the steamers in the position that they require, and, furthermore, the recent advance in outward freight rates means that the majority of them who have c.i.f. orders to execute are likely to make pretty substantial losses. Owing to the scarcity of prompt steamers, many colliery stoppages have taken place of late. Sized coals are steady, but other descriptions of large and small coals are obtainable without any difficulty. Coke and patent fuel display no material alteration, but the pitwood market is quiet at round about 28s. 6d. to 29s.

EDUCATIONAL INTELLIGENCE.

University of London, University College.—We are informed that the title of a series of lectures which is to be given in November and December, has been changed from "High-tension Transmission of Power" to "High Voltage Cables, Theory and Practice of their Design and Operation." The lectures will be delivered by Mr. Percy Dunsheath, O.B.E., M.A., B.Sc., M.Inst.E.E., on Tuesdays, at 6.30 p.m., beginning November 13th. At the first lecture the chair will be taken by Mr. Roger T. Smith, B.Sc., M. Inst. C.E., M. Inst. M.E., Fellow of the College. The lectures will be open to the public without fee or ticket.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

The Metropolitan Fuel Company, Ltd.—Cox's system of surface combustion—has removed its offices, showrooms, and works to larger premises at 43, Johnson-street, Westminster, London, S.W. 1.

Condrup, Ltd., of 77–78, Fore-street, London, E.C. 2, asks us to announce that it has taken over the agency for "Bahco" tools, covering a range of spanners of various types, pipe wrenches, cutters and vices, &c., made by Messrs. B. A. Hjorth and Co., of Stockholm.

Mr. David E. Roberts, consulting engineer, the address of whose office has until recently been 9, Richmond-terrace, Park-place, Cardiff, asks us to announce that the Corporation of the city has altered the name of this terrace to Museum-place. His address is now, therefore, 9, Museum-place, Cardiff.

Copes Regulators, Ltd., Thanet House, 231, Strand, W.C.2, has recently been formed to handle exclusively the manufacture and sale of Copes boiler feed-water regulators. James Gordon and Co., Ltd., the former licensees, will continue their activities as combustion engineers with their other specialities, at the same time having a shareholder's interest in the new company. The directors of the new company are Mr. H.W. Spencer, M.I.Mech.E., Vice-president of Liptak Furnace Arches, Ltd.; Mr. C. H. Armstrong, recently with James Gordon and Co.; Mr. E. W. Nick, President of the Northern Equipment Company, Erie, Pa., U.S.A.; and Mr. Neil H. Brown, lately assistant chief engineer of the Northern Equipment Company.

A Jubilee Celebration.—The firm of Thos. W. Ward, Ltd., of Sheffield, celebrated the fiftieth anniversary of its formation on Friday night, October 19th, by a dinner at the Royal Victoria Hotel, Sheffield. The company, which numbered over 300, consisted of directors, the Sheffield and other works staff, representatives from different parts of the country and overseas, together with forty-five of the workmen who had been employed by the company for over twenty-five years. Mr. Joseph Ward, chairman of the company, announced that in order to celebrate the jubilee, he wished to mark in a tangible way the loyal services of the staff and workpeople, and that he proposed to make a personal gift of a block of shares which would be distributed to about 250 members of the staff and workpeople who had been with the firm twenty years and upwards. The shares will be distributed in graduated amounts according to the years of service.

The Junior Institution of Engineers.—In a lecture delivered on Friday, October 19th, 1928, Mr. R. H. Sharp dealt with the question of advertising engineering products, and from his experience as an advertising consultant, stated that while a great advance had taken place of recent years in the advertising of general commodities, the advertising of technical and engineering products had remained almost stationary. The causes for this were that technical advertising was seldom so effective in so far as results were concerned as general advertising; its importance was often not realised, and the man who handled this department in an engineering firm was a technician first and an advertising man second; and that no really good advertising agency had ever been invited to take over the whole of the advertising arrangement. He considered it essential to the success of any advertisement to create an atmosphere, by the type of illustration, style of text, &c., suitable to the product, and what was even more important, to maintain that style or atmosphere in all subsequent announcements of the same firm's products, thus producing a cumulative effect which identified a particular style of announcement with a certain advertiser. The difference in the appropriation applied for advertising purposes between firms manufacturing general commodities and those making technical products was very great, the former frequently being 4 per cent. or 5 per cent. of the firm's annual turnover, and the latter frequently less than ·5 of 1 per cent. This being so, Mr. Sharp considered extra care was necessary in the latter case to ensure that the small appropriation was spent as efficiently as possible. In the discussion which followed, representatives from the Publicity Departments of several engineering firms gave their views, and whilst agreeing that carefully drawn advertisements in the technical press were undoubtedly of great use in initiating inquiries, they were of little avail unless followed up by a vigorous personal appeal either by special technical literature or the services of a thoroughly trained representative.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
(1) Native	18/6 to 21/6
(1) Spanish	18/6 to 22/6
(1) N. African	18/6 to 22/6
N.E Coast—	
Native	18/– to 21/–
Foreign (c.i.f.)	22/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	3 14 0	—
No. 1 Foundry	3 15 0 to 3 16 0	—
No. 3 Foundry	3 11 0	—
N.E. Coast—		
Hematite Mixed Nos.	3 10 0	3 10 0
No. 1	3 11 0	3 11 0
Cleveland—		
No. 1	3 8 6	3 8 6
Silicious Iron	3 8 6	3 8 6
No. 3 G.M.B.	3 6 0	3 6 0
No. 4 Foundry	3 5 0	3 5 0
No. 4 Forge	3 4 6	3 4 6
Mottled	3 4 0	3 4 0
White	3 4 0	3 4 0
Midlands—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	—	—
„ „ Foundry	3 2 6	—
(3) Northampton—		
Foundry No. 3	2 16 0 to 2 17 6	—
Forge	2 13 6	—
(3) Derbyshire—		
No. 3 Foundry	3 0 0 to 3 1 0	—
Forge	2 16 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 0 0	—
No. 4 Forge	2 17 6	—
Basic	2 19 0	—
(4) N.W. Coast—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 0 0 (a) / 4 2 6 (b) / 4 5 6 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. Coast—		
Iron Rivets	11 5 0	—
Common Bars	10 5 0	—
Best Bars	10 15 0	—
Double Best Bars	11 5 0	—
Treble Best Bars	11 15 0	—
Lancs.—		
Crown Bars	10 0 0	—
Second Quality Bars	9 10 0	—
Hoops	13 0 0	—
S. Yorks.—		
Crown Bars	10 10 0	—
Best Bars	11 0 0	—
Hoops	12 10 0	—
Midlands—		
Crown Bars	9 2 6 to 10 0 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	8 12 6 to 8 17 6	—
Gas Tube Strip	10 15 0 to 10 17 6	—

STEEL. (d)

	(6) Home. £ s. d.	(7) Export £ s. d.
(5) Scotland—		
Boiler Plates	10 10 0	10 10 0
Ship Plates, ½in. and up	8 7 6	7 12 6
Sections	7 12 6	7 2 6
Steel Sheets, ¼in.	8 15 0	8 12 6
Sheets (Gal.Cor. 24 B.G)	13 10 0	13 10 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	8 7 6	—
Angles	7 17 6	—
Boiler Plates	12 15 0	—
Joists	7 17 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	7 12 6	—
Soft Billets	6 15 0	—
N.W Coast—		
Barrow—		
Heavy Rails	8 0 0	—
Light Rails	8 5 0 to 8 10 0	—
Billets	6 15 0 to 9 15 0	—
Manchester—		
Bars (Round)	8 17 6	—
„ (Small Round)	7 17 6 to 8 0 0	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 12 6 to 8 17 6	—
„ (Lancs. Boiler)	9 10 0 to 9 15 0	—
Sheffield—		
Siemens Acid Billets	9 5 0 to 9 10 0	—
Hard Basic	7 2 6 and 7 12 6	—
Intermediate Basic	7 0 0	—
Soft Basic	6 10 0	—
Hoops	9 0 0	—
Soft Wire Rods	7 5 0 to 7 10 0	—
Midlands		
Small Rolled Bars	7 15 0 to 8 0 0	—
Billets and Sheet Bars	6 7 6 to 6 10 0	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 10 0 to 13 15 0	—
Angles	7 17 6	—
Joists	7 17 6	—
Tees	8 17 6	—
Bridge and Tank Plates	8 12 6	—
Boiler Plates	11 0 0	—

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	18/– to 18/3
Block Tin (cash)	222 5 0
„ (three months)	220 2 6
Copper (cash)	66 0 0
„ (three months)	66 10 0
Spanish Lead (cash)	22 3 9
„ (three months)	21 16 3
Spelter (cash)	24 1 3
„ (three months)	24 6 3
Manchester—	
Copper, Best Selected Ingots	70 15 0
„ Electrolytic	72 15 0
„ Strong Sheets	96 0 0
„ Tubes (Basis Price), lb.	0 1 1½
Brass Tubes (Basis Price), lb.	0 1 0½
„ Condenser, lb.	0 1 2½
Lead, English	23 12 6
„ Foreign	22 5 0
Spelter	24 7 6
Aluminium (per ton)	£107

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/8 per lb.	
Ferro Tungsten	1/3 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£21 10 0	7/6
„ „ 6 p.c. to 8 p.c.	£20 10 0	7/–
„ „ 8 p.c. to 10 p.c.	£20 0 0	6/–
„ „ Specially refined		
„ „ Max. 2 p.c. carbon	£33 0 0	12/–
„ „ „ 1 p.c. carbon	£37 0 0	15/–
„ „ „ 0·70 p.c. carbon	£41 0 0	17/–
„ „ „ carbon free	1/– per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£13 15 0 for home; £13 10 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£12 0 0 scale 5/– per unit	
„ „ 75 p.c.	£19 0 0 scale 6/– per unit	
„ Vanadium	14/– per lb.	
„ Molybdenum	4/3 per lb.	
„ Titanium (carbon free)	1/2 per lb.	
Nickel (per ton)	£170 to £175	
Ferro-Cobalt	9/– per lb.	

FUELS.

SCOTLAND.
(Prices not stable.)

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	13/9
„ „ Ell	16/–
„ „ Splint	15/9 to 16/–
„ „ Trebles	13/6 to 14/–
„ „ Doubles	13/6
„ „ Singles	12/9
Ayrshire—	
(f.o.b. Ports)—Steam	13/6
„ „ Jewel	15/6
„ „ Trebles	13/9
Fifeshire—	
f.o.b. Methil or Burntisland—Steam	11/9 to 12/9
Screened Navigation	18/–
Trebles	14/9 to 16/–
Doubles	13/–
Singles	12/9
Lothians—	
(f.o.b. Leith)—Best Steam	12/3 to 12/6
Secondary Steam	11/9
Trebles	15/–
Doubles	13/6
Singles	12/9

ENGLAND.

	Inland.
(8) N.W. Coast—	
Steams	25/6
Household	38/6 to 51/–
Coke	22/6 to 23/6
Northumberland—	
Best Steams	13/9 to 14/–
Second Steams	12/9 to 13/–
Steam Smalls	9/– to 9/6
Unscreened	11/9 to 12/–
Household	21/– to 27/–
Durham—	
Best Gas	14/9
Second	13/– to 13/3
Household	21/– to 27/–
Foundry Coke	18/6 to 19/6
Sheffield—	
Best Hand-picked Branch	26/– to 27/6 —
Derbyshire Best Bright House	23/– to 24/6 —
Best House Coal	20/6 to 21/6 —
Screened House Coal	17/– to 18/– —
„ „ Nuts	16/– to 18/– —
Yorkshire Hards	14/6 to 16/– —
Derbyshire Hards	14/6 to 16/– —
Rough Slacks	8/6 to 9/6 —
Nutty Slacks	4/6 to 6/– —
Smalls	3/– to 4/6 —
Blast-furnace Coke (Inland)	13/6 at ovens —
Furnace and Foundry Coke (Export), f.o.b.	19/– to 19/6

(9) SOUTH WALES.

Cardiff—	
Steam Coals :	
Best Smokeless Large	19/3 to 19/6
Second Smokeless Large	18/– to 19/3
Best Dry Large	17/9 to 18/6
Ordinary Dry Large	17/ to 17/3
Best Black Vein Large	17/6 to 17/9
Western Valley Large	17/– to 17/3
Best Eastern Valley Large	16/6 to 17/–
Ordinary Eastern Valley Large	16/3 to 16/6
Best Steam Smalls	12/6 to 13/–
Ordinary Smalls	10/6 to 12/–
Washed Nuts	18/– to 20/–
No. 3 Rhondda Large	19/6 to 20/–
„ „ Smalls	14/– to 14/6
No. 2 „ Large	16/– to 16/6
„ „ Through	14/6 to 15/6
„ „ Smalls	11/– to 12/–
Foundry Coke (export)	27/– to 37/–
Furnace Coke (export)	19/– to 21/–
Patent Fuel	20/– to 21/6
Pitwood (ex ship)	28/6 to 29/–
Swansea—	
Anthracite Coals :	
Best Big Vein Large	34/– to 35/6
Seconds	24/6 to 27/6
Red Vein	21/– to 27/–
Machine-made Cobbles	40/– to 43/6
Nuts	35/– to 43/6
Beans	23/6 to 25/–
Peas	18/– to 18/6
Breaker Duff	8/– to 8/6
Rubbly Culm	10/9 to 11/3
Steam Coals :	
Large	17/6 to 18/6
Seconds	16/– to 17/–
Smalls	12/– to 12/6
Cargo Through	15/– to 16/–

(1) Delivered. (2) Net Makers' Works. (3) f.o.t. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/– extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham. (d) Rebate 12/6 joists and 10/– all other materials if home consumers confine purchases solely to British products.

French Engineering Notes.

(From our own Correspondent in Paris.)

Reinforced Concrete.

THE collapse of a seven-storey building which was nearing completion at Vincennes, following upon similar accidents in other places, has revealed that there is at times an entire lack of care in the use of reinforced concrete. Greater skill and experience are necessary in the use of armoured concrete than in the erection of steel girders, because every stage of its preparation must be verified by experts, and the material must set before any load can be put upon it. In the case of the Vincennes accident there was no such control. The builder, who was himself the owner, did not employ an architect, but the workmen employed were mainly Italians, who are generally specialists in concrete. In the course of construction the building developed cracks, which were filled by injections of cement. When it collapsed, involving the loss of about twenty lives, there was a strong agitation in favour of measures being taken to insure that all armoured concrete constructions in future should be under the supervision of qualified architects. This again raises the question of the status of architects, which is less clearly defined in this country than elsewhere, and it is hoped that the accident will result not only in measures being taken to avoid the recurrence of such disasters, but also a definite status being given to architects who are particularly qualified to take charge of reinforced concrete work.

Normalisation.

The Minister of Commerce has issued a circular to all the Chambers of Commerce, associations and syndicates throughout the country pointing out the necessity of adapting a system of "normalisation" to all branches of industry, whereby production will be facilitated, costs reduced and advantages will be conferred upon the whole mass of consumers. The word "normalisation" has been substituted for standardisation, and may be taken as offering a more general meaning, since it implies the carrying of standardisation beyond the usual sense of the term. Several bodies already exist for the purpose. There is the official Commission Permanente de Standardisation created in 1918, and also the Association Française de Normalisation under the presidency of Monsiuer Rateau, as well as a number of "bureaux de normalisation" which have been formed in different branches of industry. One of these is the Comité de Normalisation de la Mécanique, which is making an inquiry amongst machine tool makers and users to ascertain whether it will be advisable to standardise the speeds and feeds, numbers of pulley revolutions and dimensions of pulleys, with a view of facilitating calculations when setting up work. A great deal has already been done in the way of creating standards, and French manufacturers wish to carry it as far as possible, because they see in this "normalisation" a means of securing a preference for French machines over the foreign, which latter would presumably not always fulfil the requirements of users if the proposed system of "normalisation" were to be generally accepted and become a habit amongst those employing machine tools. With such a variety of cutting tools on the market, however, it is by no means certain that machine tool users will care to lose any benefit they may derive by running at a little more than the standard speed, if by so doing they can increase the output.

Sales' Organisations.

It is of equal importance to sell goods as to manufacture them, and now that the production in nearly every branch of industry has exceeded the consumption, more attention is given to the distribution of goods under conditions that will avoid unprofitable prices. The principle nowadays is to concentrate in everything. While the production of steel is controlled, nothing has yet been done in the way of organising sales for export, although it is believed that that step is inevitable in the more or less early future; but in the coal trade the organising of sales is likely to precede any limitation of output, which is, moreover, assured by the limitation of demand. Notwithstanding the approach of the winter season, stocks of coal are so heavy that coalowners find it necessary to do all they can to facilitate sales. In Belgium the negotiations for the formation of a sales' comptoir are nearly completed. About 90 per cent. of the producers of coke and patent fuels have adhered to the new sales' bureau, and as regards industrial coals, there is unanimity in the Borinage, Centre and Campine, while in the Charleroi basin it is expected that satisfactory arrangements will be made shortly. The only trouble is in the Liége basin, where there are numerous small coalowners, amongst whom it is not easy to come to a complete understanding, but it is believed that the interests of all concerned will be so far safeguarded that it will be possible to start operations for centralising sales of coal and coke at an early date.

Foreign Trade.

The returns of foreign trade during the first nine months of the year imply that there has been for some months past a continuous contraction of exports, except so far as regards "material necessary for industry," such as iron and steel and other products, which continue to be sent away in larger quantities but at considerably lower prices. The total value of imports was 38,768 million francs, an increase of 328 million francs as compared with the similar period of last year, the greatest increase being in manufactured goods, the value of which was 5581 million francs, an augmentation of 1388 million francs. This may be due to the quantity of goods received from Germany on account of reparations. The exports totalled 37,551 million francs, a declension as compared with the similar period of 1927 of 2518 million francs. The exports of manufactured goods were valued at 23,441 million francs, a decline of 660 million francs. The returns indicate that France is selling iron and steel and raw material abroad at lower prices and is buying larger quantities of manufactured goods.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

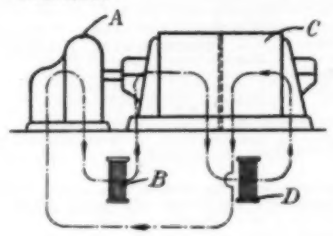
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

DYNAMOS AND MOTORS.

276,654. August 10th, 1927.—IMPROVEMENTS IN COOLING SYSTEMS FOR DYNAMO ELECTRIC MACHINES, Aktiengesellschaft Brown Boveri & Cie., of Baden, Switzerland.

For cooling dynamo-electric machines, large quantities of air are required. Hitherto the surfaces to be cooled have been swept over in parallel by the air, so that the blowers or fans have to convey a large quantity of air at relatively low pressure. It is difficult to design fans for such large quantities of air and relatively small pressures with a high speed of revolution and a good efficiency. For this reason these fans have been placed externally of the dynamo electric machine in separate casings and driven independently at a low speed of revolution. This,

Nº 276,654



however, results in large dimensions and consequently in expensive fans, for which it is often difficult to find space. The object of this invention is to overcome these drawbacks. The air is forced by the fan A through the first cooler B. It then flows through the left-hand section of the machine C, and leaves the latter in the middle and flows through the intermediate cooler D. It then passes to the right-hand section of the machine, and leaves the latter in the middle and flows back to the suction branch of the fan A. The arrangement is such that the cooled air enters at both ends of the machine in order that a plentiful supply of cold air may sweep over the winding ends.—*September 13th*, 1928.

SWITCHGEAR.

296,879. August 16th, 1927.—IMPROVEMENTS IN OR RELATING TO ELECTRICAL SWITCHGEAR, Arthur Edwin Leigh Scanes, of "Strathfield," Harboro-road, Ashton-on-Mersey, and Metropolitan-Vickers Electrical Company, Ltd., of 4, Central Buildings, Westminster.

It has been found that under certain conditions, such as frequently arise during the shipping of armour-clad switchgear through the tropics, the insulating compound flows from its

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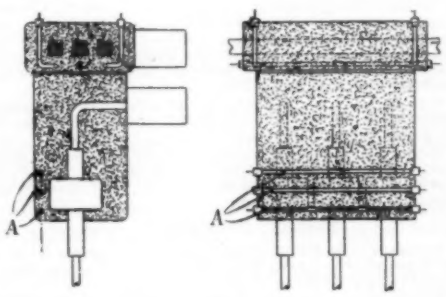

correct position and causes undesirable cavities to form which are difficult and inconvenient to deal with. According to this invention the difficulty is obviated wholly or in part by incorporating within the armouring of the switchgear and immersed in the insulating compound, electrical heaters A, which can be supplied with electric current for the purpose of re-melting the compound. One or more heaters may be provided in each compound-filled chamber of the switchgear as a permanent part of the equipment.—*September 13th*, 1928.

TRANSFORMERS AND CONVERTERS.

296,878. August 12th, 1927.—IMPROVEMENTS RELATING TO BOOSTING TRANSFORMERS WITH PARALLEL CONNECTED WINDINGS, Graham Leigh Porter and Ferranti, Ltd., of Great Britain, both of Hollinwood, Lancashire.

The invention consists briefly in the provision of two primary

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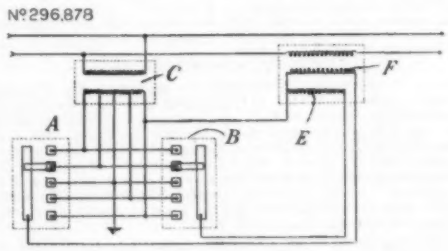

windings in a boosting transformer each with its own selecting switchgear arranged so that the connections to these individual windings from the regulating transformer may be changed consecutively, one winding temporarily carrying the load while the connection to the other is being changed. Two switches A, B with interconnected contacts are provided, these interconnections being connected to progressive tapping points on the secondary winding of the regulating transformer C. The switches A, B which are connected respectively to the two primary windings E, F of the boosting transformer are operated alternately when it is desired to alter the tapping point connection to the transformer C.—*September 13th*, 1928.

TRANSMISSION OF POWER.

290,225. May 10th, 1928.—LUBRICATING SPUR GEARS, The International General Electric Company, Inc., 120, Broadway, New York.

The usual separate pumping system used for lubricating spur gears is, in this case, eliminated by making the gears themselves act as an oil pump. The larger gear wheel is embraced by a cover A, which reaches nearly to the point of engagement of

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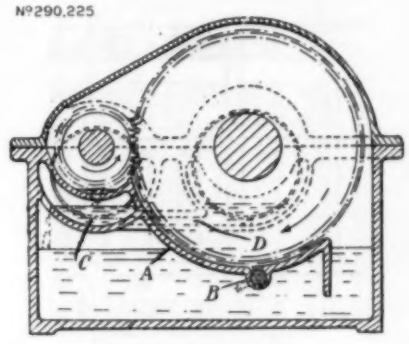

the two wheels. This cover dips below the level of the oil in the main casing, and the rate of flow of oil into it can be regulated by the tap B. The surplus oil coming from the teeth of the wheels drops into the tank C, and is picked up by rings to lubricate the bearings, while a passage D provides a supply of oil for similar purposes in connection with the other bearings.—*September 13th*, 1928.

MEASURING AND TESTING INSTRUMENTS.

296,812. June 9th, 1927.—ELECTRIC PHASE-DIFFERENCE INDICATING DEVICES, The British Thomson-Houstion Co., Ltd., of Crown House, Aldwych, London, W.C. 2, and Herbert Stanley Petch, of 80, Dollis Hill-avenue, London, N.W. 2.

This invention relates to arrangements for indicating the phase-difference between two electric quantities, and has special reference to power factor indicators. A potential transformer A supplies from the alternating current circuit B potential variations in accordance with the voltage of the circuit simultaneously to the two grids of a pair of thermionic devices C and

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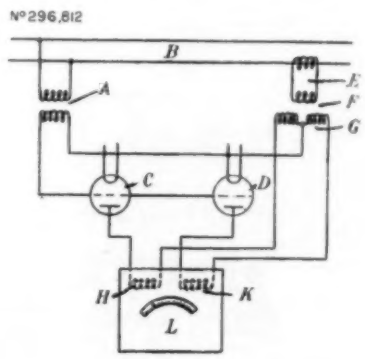

D. A current transformer E is used to energise differentially the anodes of the devices C and D. The transformer E supplies an auxiliary transformer F having a secondary winding G, the middle point of which is connected to the cathodes of the two valves. The outer ends of the secondary winding are connected respectively through the two coils H and K of a differential milli-ammeter L to the anodes of the two valves. The secondary winding G is designed so as to produce a voltage of suitable value having regard to the characteristics of the two thermionic devices. The differential milli-ammeter L may be calibrated to read directly as a power factor indicator.—*September 10th*, 1928.

FURNACES.

296,924. November 23rd, 1927.—MECHANICAL STOKERS, H. E. Yarrow, Scotstoun, Glasgow.

This invention relates to mechanical stokers, more particularly to chain grate stokers, and has for its object to prevent the coal from caking on the grate at the hopper or inlet end soon after

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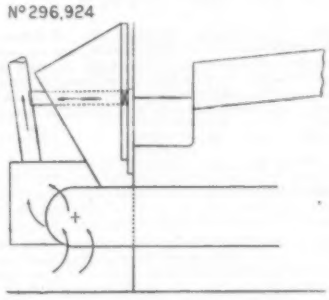


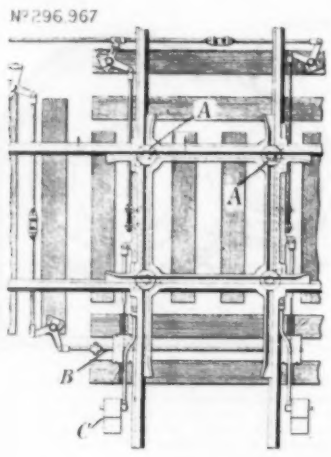
the coal enters the furnace and before it can be properly ignited. The result of such caking is that the coal above the sticky mass or cake on the grate never burns and passes into the ashpit as unburned fuel, and, moreover, owing to the free flow of air being cut off by the caked fuel, the free combustion of the fuel is affected and the ignition arch becomes cool, so that the ignition of the

whole of the coal on the grate is delayed and the fire generally gets into an unsatisfactory condition. According to the present invention this caking of the fuel on the grate and the defective combustion arising therefrom are prevented by boxing in the front end of the grate which projects outside the fuel hopper, and inducing a rapid current of air from the stokehold through the lower and upper flights of this part of the grate to the box and thence to a duct from which the air is returned to the system, as by connecting this duct with the inlet of the forced draught fan.—*September 13th*, 1928.

TRAMWAYS AND RAILWAYS.

296,967. May 25th, 1928.—Railway Crossings, *L. Mellersh-Jackson*, 28, *Southampton Buildings, Chancery-lane, London, W.C.* 2.

In this crossing, the gaps between the rails required for the purpose of the wheel flanges are closed by little grooved "turn-

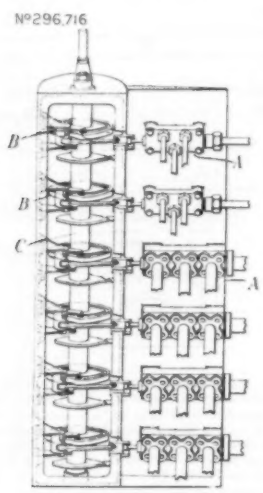


tables" A, which may be rotated through an angle of 90 deg. to provide a free passage in either direction. The turntables are operated by racks and pinions, which are interconnected by linkage, as shown, while an interlock is provided at B and a signalling device, for indicating the immediate position of the turntables, is arranged at C.—*September 13th*, 1928.

ORDNANCE AND ARMOUR.

296,716. May 31st, 1927.—Gun Mountings, Sir W. G. Armstrong, Whitworth and Co., Ltd., H. W. Lee and J. F. Rowell, Elswick Works, Newcastle-on-Tyne.

This invention might be described as the application of the electric tramcar controller principle to the manipulation of large guns. All the actual movements of the gun and its accessories



are operated hydraulically, and the hydraulic motors are controlled by a series of valves A A arranged in one casing. These valves are manipulated by a set of cams B B, all attached to one shaft C in such a manner that the various operations must be carried out in the proper sequence. Interlocking means are provided, but some of the operations can be cut out of the programme deliberately if it is so desired.—*August 31st*, 1928.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME and PLACE at which the meeting is to be held should be clearly stated.

TO-DAY.

Institution of Chemical Engineers.—In the Lecture Theatre of the Institution of Civil Engineers, Great George-street, Westminster, London, S.W. 1. "Fluid Jets and Their Practical Applications," by Professor A. L. Mellanby. 6.30 p.m.

Institution of Electrical Engineers: North-Eastern Students' Section.—Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. "Post Office Telephones and the Public," by Mr. L. B. Harmer. 7.15 p.m.

Institution of Locomotive Engineers.—Hotel Metropole, Leeds. "Glimpses of Colonial Railway Conditions," by Mr. E. De H. Rowntree. 7 p.m.

Institution of Mechanical Engineers.—Storey's-gate, St. James's Park, London, S.W. 1. Informal meeting. "Mechanical Plant in Gasworks," introduced by Mr. R. C. Macdonald. 7 p.m.

Institution of Mining Engineers.—Annual general meeting, London; conclusion. For programme see page 401.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. "Legal Protection for Originality and Inventions," by Mr. G. W. Tookey. 7.30 p.m.

Manchester Association of Engineers.—Engineers' Club, Albert-square, Manchester. Discussion, "The Microscope as Applied to Engineering," by Mr. J. S. G. Primrose. 7.15 p.m.

The Physical Society.—Imperial College of Science, South Kensington, S.W. 7. "An Experimental Study of the Anticlastic Bending of Rectangular Bars of Different Cross Sections," by Dr. Allan Ferguson and Mr. Jas. P. Andrews; "An Instrument for the Production of Known Small High-frequency Alternating Electromotive Forces," by Mr. B. S. Smith and Mr. F. D. Smith. A demonstration of a new device for thermostatic control will be given by Mr. H. F. T. Jarvis. 5 p.m. Editing Committee meeting, 3.30 p.m.; Council meeting, 4 p.m.

SATURDAY, OCTOBER 27th.

Institute of British Foundrymen: Lancashire Branch, Junior Section.—College of Technology, Sackville-street, Manchester. Presidential address, by Mr. T. Makemson. 7 p.m.

Institution of Municipal and County Engineers.—Town Hall, Pontefract. Yorkshire District Meeting. 1.45 p.m.

MONDAY, OCTOBER 29th.

Bradford Engineering Society.—Technical College, Bradford. "Time Recording and Costing," by Mr. A. H. Gledhill. 7.30 p.m.

Illuminating Engineering Society.—Electric Lighting Service Bureau, 4, Fountain-street, Manchester. "An Investigation of Electric Lighting in the Engineering Industry," by Mr. J. L. H. Cooper. 7 p.m.

Institution of Electrical Engineers.—Victoria Embankment, London, W.C. 2. Informal meeting. Discussion on "Our Profession from a Manufacturer's Point of View," to be opened by the President, Lieut.-Col. K. Edgcumbe. 7 p.m.

TUESDAY, OCTOBER 30th.

Royal Institution of Great Britain.—21, Albemarle-street, Piccadilly, London, W. 1. "The Change of State from Liquid to Vapour," by Professor H. L. Callendar, F.R.S. 5.15 p.m.

The Institution of Electrical Engineers: North Midland Centre.—At the Hotel Metropole, Leeds. Opening address, by Mr. F. S. G. Hinings. 7 p.m.

University of London.—King's College, Strand, London, W.C. 2. "A Hundred Years of Naval Engineering," Lecture III. by Engineer-Captain Edgar C. Smith, R.N., Retd. 5.30 p.m.

WEDNESDAY, OCTOBER 31st.

Illuminating Engineering Society.—North-East Coast Lighting Service Bureau, Dial House, Northumberland-street, Newcastle-on-Tyne. "An Investigation of Electric Lighting in the Engineering Industry," by Mr. J. L. H. Cooper. 7.15 p.m.

Institution of Municipal and County Engineers.—Town Hall, Accrington. Informal discussion on "Bricks and Brickmaking," at 11.30 a.m. Visit to the Accrington Brick and Tile Company's Works. 2.15 p.m.

The Faraday Society and the Electroplaters' and Depositors' Technical Society.—A joint meeting in the Lecture Theatre, Northampton Polytechnic Institute, St. John-street, E.C. 1. The following papers will be discussed:—"The Causes and Prevention of Pitting in Electro-deposited Nickel," by Messrs. D. J. Macnaughtan and A. W. Hothersall; "On the Effect of Colloids in the Electro-deposition of Silver from Silver Nitrate Solutions," by Mr. S. Wernick; "The Hardness of Electro-deposited Nickel," by Messrs. D. J. Macnaughtan and A. W. Hothersall; "Investigations on the Electro-deposition of Silver," by Mr. Edward B. Sanigar. 8.15 p.m.

THURSDAY, NOVEMBER 1st.

Illuminating Engineering Society.—Central Halls, 25, Bath-street, Glasgow. "An Investigation of Electric Lighting in the Engineering Industry," by Mr. J. L. H. Cooper. 7.30 p.m.

Institution of Electrical Engineers: South Midland Centre.—Municipal Technical College, Suffolk-street, Birmingham. Joint meeting with the Electrical Association for Women. Faraday Lecture, "Electricity in the Service of Man," by Dr. S. Z. De Ferranti, F.R.S. 7 p.m.

Institution of Mechanical Engineers: Yorkshire Branch.—At the University, Leeds. "Gaseous Explosions," by Mr. B. H. Thorp. 7.30 p.m.

Royal Aeronautical Society.—At the House of the Royal Society of Arts, John-street, Adelphi, London, W.C. 2. "The Testing of Adhesives for Timber," by Mr. W. D. Douglas and Miss C. B. Pettifor. 6.30 p.m.

FRIDAY, NOVEMBER 2nd.

Institution of Engineering Inspection.—In the House of the Royal Society of Arts, John-street, Adelphi, London, W.C. 2. "Die Casting," by Mr. A. H. Mundey. 5 p.m.

Institution of Municipal and County Engineers.—Hams Hall Power Station, Birmingham. Inspection of works in progress. Leave the Council House, Birmingham, 2 p.m.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. Film, "The Babcock Boiler." 7.30 p.m.

North-East Coast Institution of Engineers and Shipbuilders.—Bolbec Hall, Newcastle-upon-Tyne. "From Theoretical Hydrodynamics to Practical Ship Design," by Mr. E. G. Barrillon. 6 p.m.

University of London.—University College, Gower-street, London, W.C. 1. "Smoke Pollution of the Air and Public Health," Lecture I., by Dr. John Owens. 5.30 p.m.

SATURDAY, NOVEMBER 3rd.

Royal Institution of Great Britain.—21, Albemarle-street, Piccadilly, London, W. 1. "The Planets," by Rev. T. E. R. Phillips. 3 p.m.

MONDAY, NOVEMBER 5th.

The Society of Engineers.—In the Apartments of the Geological Society, Burlington House, W. "The Future of Engineering in the Light of Modern Economic Industrial and Political Conditions," by Mr. C. R. Enock. 6 p.m.

TUESDAY, NOVEMBER 6th.

The Illuminating Engineering Society.—32, Victoria-street, London, S.W. 1. At the Lighting Service Bureau, 15, Savoy-street, Strand, W.C. 2. A brief report on progress during the vacation will be presented by the Hon. Secretary. Mr. C. C. Paterson will deliver an address dealing with "The International Illumination Congress in the United States." Reports by the Committees on Progress in Gas and Electric Lighting will be presented. Various exhibits—new lighting fittings, illuminated signs, photometers—illustrating progress in illuminating engineering will be demonstrated. 6.30 p.m.

The Institute of Metals: Birmingham Local Section.—In the Engineers' Club, Waterloo-street, Birmingham. "Drop Forging and Machine Forging," by Mr. F. W. Spencer. 7 p.m.

The Institute of Metals: North-East Coast Local Section.—In the Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. "Deformation of Metals," by Professor Cecil H. Desch, F.R.S. 7.30 p.m.

WEDNESDAY, NOVEMBER 7th.

Institution of Electrical Engineers: Wireless Section.—Savoy-place, Victoria Embankment, W.C. Opening address by the Chairman, Commander J. A. Slee. 6 p.m.

THURSDAY, NOVEMBER 8th.

Institution of Civil Engineers: Birmingham and District Association.—Birmingham Chamber of Commerce. "Modern Methods of Sewage Disposal," by Mr. A. E. Sadler. 6 p.m.

Institution of Municipal and County Engineers.—Deptford Town Hall. "Granite Setts in and Around London: Some Factors Affecting their Wear: Description of Micro-structure of Granite Setts," illustrated by lantern slides, by Mr. B. H. Knight. Exhibition of rock cutting methods by Mr. W. J. Pickering. 6 p.m.

Institution of Structural Engineers.—10, Upper Belgrave-street, London, S.W. 1. Presidential address, by Lieut.-Col. J. Mitchell Moncrieff. 6.30 p.m.

Royal Aeronautical Society.—At the House of the Royal Society of Arts, John-street, Adelphi, London, W.C. 2. "The Machinery Installation of 'R 101,'" by Wing-Commander T. R. Cave-Browne-Cave,. 7.45 p.m.

The Institute of Metals: London Local Section.—At the Royal School of Mines, South Kensington, S.W. 7. "The Plastic Contour," by Professor W. E. Dalby, F.R.S. 7.30 p.m.

FRIDAY, NOVEMBER 9th.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. Annual general meeting. 7.30 p.m.

Keighley Association of Engineers.—Room 14, Temperance Institute, Keighley. "Precise Length and Angular Measurement," by Mr. C. H. Carter. 7.30 p.m.

The Faraday Society.—In the Lecture Theatre of the Royal Institution, Albemarle-street, London, W. 1. The first Spiers Memorial Lecture, "Some Debatable Problems in Physics," by Sir Oliver Lodge. 3.30 p.m.

The Institute of Metals: Sheffield Local Section.—In the Non-ferrous Section, Applied Science Department, the University, St. George's-square, Sheffield. "Flow in Metal Shaping Processes," by Professor F. C. Thompson. 7.30 p.m.

MONDAY, NOVEMBER 12th.

Institution of Electrical Engineers.—Victoria Embankment, London, W.C. 2. Informal meeting. Discussion on "Engineering Requirements of a Modern Office Building," opened by Mr. J. Coxon. 7 p.m.

The Institute of Metals: Scottish Local Section.—In the Rooms of the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank-crescent, Glasgow. "Nickel in the Non-ferrous Foundry," by Mr. A. C. Sturney. 7.30 p.m.

Societe des Ingenieurs Civils de France.—Institution of Mechanical Engineers, Storey's Gate, S.W. 1. "Twin Gyro Stabiliser," by M. Fieux, M. Soc. C.E. (France). 5.30 p.m.

TUESDAY, NOVEMBER 13th.

Institute of Marine Engineers.—85/88, The Minories, Tower Hill, London, E. 1. "Air Transport," by Major R. H. Mayo. 6.30 p.m.

Manchester Association of Engineers.—Engineers' Club, Albert-square, Manchester. "The Electrification of the Pietermaritzburg-Glencoe Section of the South African Railways," by Mr. F. Lydall. 7 p.m.

University of London.—University College, Gower-street, London, W.C. 1. "High-tension Transmission of Power," Lecture I., by Mr. Percy Dunsheath. 6.30 p.m.

WEDNESDAY, NOVEMBER 14th.

Belfast Association of Engineers.—Central Hall, Municipal College of Technology, Belfast. "Low-pressure Hot Water Heating," by Mr. A. W. Brown. 7.30 p.m.

Institution of Chemical Engineers.—In the Lecture Theatre of the Institution of Civil Engineers, Great George-street, Westminster, London, S.W. 1. "Making Rubber Goods of Latex by Electro-deposition," by Dr. Paul Klein, of Budapest. 6.30 p.m.

Institution of Mechanical Engineers: Yorkshire Branch.—Grand Hotel, Sheffield. "Corrosion of Metals and its Prevention," by Mr. H. E. Yerbury. 7.30 p.m.

THURSDAY, NOVEMBER 15th.

Institution of Mechanical Engineers: Yorkshire Branch.—Hotel Metropole, Leeds. "Corrosion of Metals and its Prevention," by Mr. H. E. Yerbury. 7.30 p.m.

The Institute of Metals: Birmingham Local Section.—In the Engineers' Club, Waterloo-street, Birmingham. Open discussion on "Standardisation." 7 p.m.

FRIDAY, NOVEMBER 16th.

Institution of Engineers and Shipbuilders in Scotland.—Grosvenor Restaurant, Gordon-street, Glasgow. The "James Watt" Lecture.

Institution of Locomotive Engineers: North-Eastern Centre.—Hotel Metropole, Leeds. "The Locomotive Smokebox," by Mr. E. Windle. 7 p.m.

SATURDAY, NOVEMBER 17th.

Institute of British Foundrymen: Lancashire Branch, Junior Section.—College of Technology, Sackville-street, Manchester. "Shrinkage Holes in Small Grey Iron Castings," by Mr. P. A. Russell. 7 p.m.

THURSDAY, NOVEMBER 22nd.

Institution of Civil Engineers: Birmingham and District Association.—Birmingham Chamber of Commerce. "Notes on a Storm Water Pumping Plant," by Mr. R. C. Moon. 6 p.m.

Institution of Structural Engineers.—10, Upper Belgrave-street, S.W. 1. "Recent Improvements in the Strength and Constructive Value of Portland Cement." 6.30 p.m.

FRIDAY, NOVEMBER 23rd.

Manchester Association of Engineers.—Engineers' Club, Albert-square, Manchester. "Electric Traction on Railways," by Mr. R. Brooks. 7.15 p.m.

TUESDAY, NOVEMBER 27th.

Institution of Engineering Inspection.—Hyde Park Hotel, London. Annual reception and dance. 8.30 p.m.

The Institute of Metals: Birmingham Local Section.—In the Engineers' Club, Waterloo-street, Birmingham. "Electric Furnace Developments," by Mr. D. F. Campbell. 7 p.m.

The Institution of Electrical Engineers: North-Eastern Centre.—At the Central Station Hotel, Newcastle-on-Tyne. Annual dinner and reunion. 7 p.m.

FRIDAY, NOVEMBER 30th.

Institution of Electrical Engineers: South Midland Centre.—Grand Hotel, Birmingham. Annual dinner. 7 p.m.